B L I S T E R   R U S T   W O R K

I N   T H E   F A R   W E S T

January 1 to December 31, 1930.

Spokane Branch
Office of Blister Rust Control
618 Realty Building
Spokane, Washington

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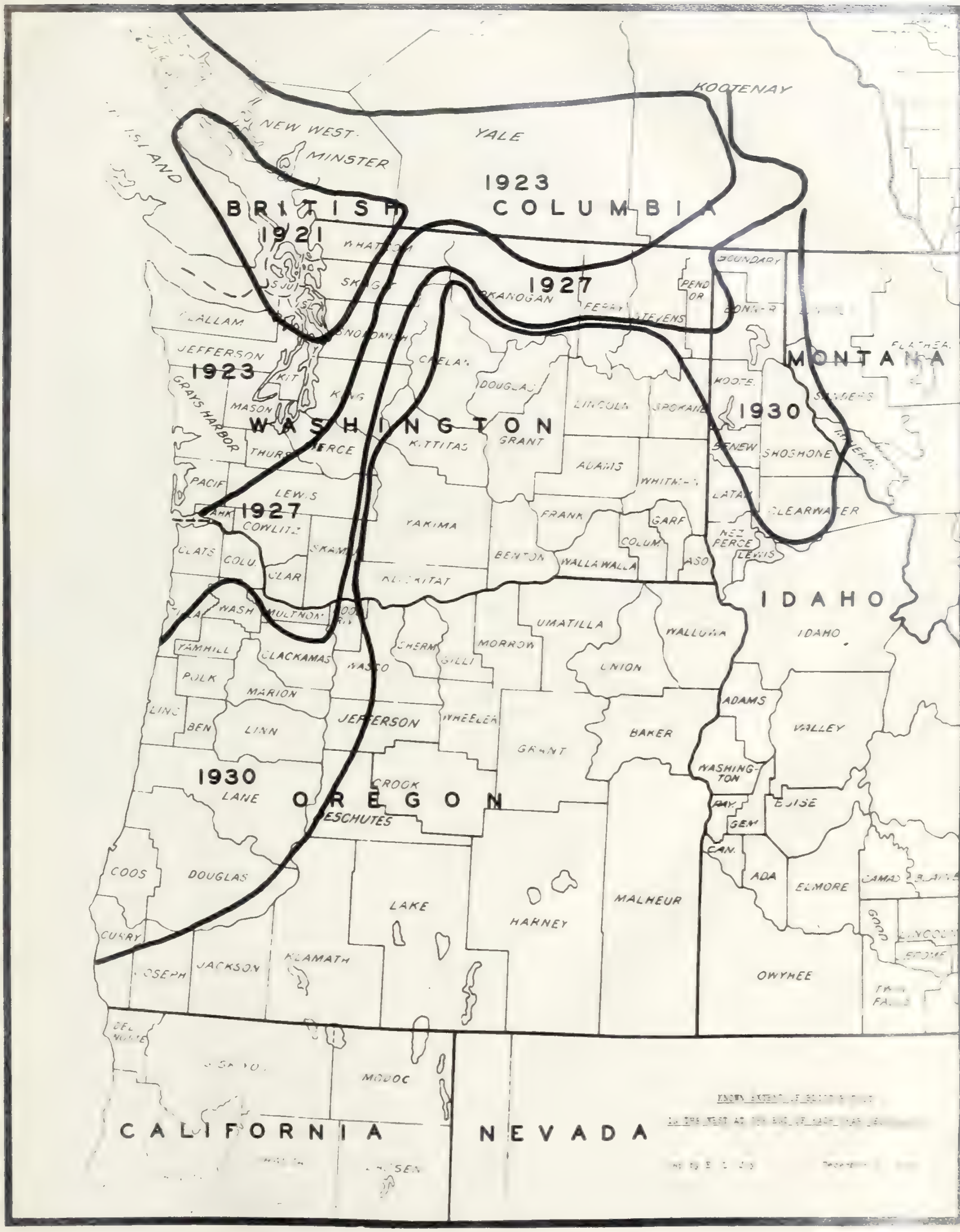

BRITISH COLUMBIA
NEW WESTMINSTER
YALE
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1921
1923
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1930
WASHINGTON
WHATCOM
SKAGIT
SNOHOMISH
CLALLAM
JEFFERSON
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MASON
KING
THURS
PIERCE
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COLU.
CLAR
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OKANOGAN
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YAKIMA
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MULTNOM
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CLACKAMAS
POLK
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NEZ PERCE
LEWIS
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WASHINGTON
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BOISE
CAN.
ADA
ELMORE
OWYHEE
MONTANA
SANDERS
MINERAL
FLATHEA.
CALIFORNIA
DEL NORTE
MODOC
NEVADA

BLISTER RUST WORK IN THE FAR WEST

January 1 to December 31, 1930

* * * * * *

INTRODUCTION

Blister rust control activities in the Far West during the calendar year 1930 were divided between the newly started control operations and the continuation of the experimental program. Cooperative stream type Ribes eradication was continued in the Clearwater and Potlatch timber protective associations upon the same basis as in 1929, the Federal Government expending two dollars for every one dollar of state and private funds. Reference to the reports upon these projects will show that considerably greater headway was made during 1930 than in 1929. This was largely due to the fact that easier working conditions were encountered, although the field organizations concerned were undoubtedly more effective, due to their year of experience. This work is evidently progressing in a manner satisfactory to our cooperators. We are undoubtedly justified in the statement that each season of successful work increases the confidence of the cooperating agencies in our organization.

So far as can be seen at the present time, it appears reasonably certain that Ribes eradication will be carried to conclusion upon the white pine type lands of the national forests of Region 1, and upon at least three of the five timber protective associations of north Idaho. Should this be done we shall be assured that approximately 75% of the white pine acreage in the Inland Empire will be protected from blister rust.

During 1930 a small start was made upon control operations on national forest lands. The appropriation of $35,000.00 secured by the Forest Service was expended upon stream type Ribes eradication in the Clearwater National Forest. For this work the Office of Blister Rust Control supplied and carried upon its payrolls one project supervisor and three camp bosses. This arrangement was in agreement with the general plan agreed upon by the Bureau of Plant Industry and the Forest Service regarding technical supervision of blister rust control operations upon national forest lands. The arrangement proved to be a most happy one in that it resulted in the most cordial of cooperative relations and in the performance of a most creditable volume of work.

The period of time during which experimental and developmental work has been done upon western blister rust control methods is now bearing fruit, not in the completion of such work but in the narrowing

and sharper delimitation of its objectives. Experimental work during the past years has developed methods of hand eradication for the upland types and of chemical eradication for Ribes petiolare in the stream type of the Inland Empire which are at least physically feasible and sufficiently low in cost to form the basis of actual control operations. This progress will henceforth make it possible to sharply drive upon the problem of less costly eradication of R. inerme and R. lacustre in the stream type. With the concentration of effort upon this problem that will henceforth be possible, it is felt that its solution will soon be reached.

The development of control practices suitable to the sugar pine region of California was satisfactorily continued in 1930. The work during the past year consisted of re-eradication of Ribes upon areas which had previously been worked. By means of this experimental project considerable knowledge was gained of the habits of the Ribes species naturally occurring in association with sugar pine and sounder conjectures as to the ultimate form of control work in California are now possible.

By the end of 1930, 15 centers of pine infection were known to exist in the Inland Empire, 14 of these being in Idaho and one in extreme eastern Washington. 14 of these 15 centers are as yet well confined to pines growing in intimate association with stream type Ribes; the fifteenth center, occurring upon an area which has very little concentration of Ribes in the stream type, has shown a disconcerting tendency to utilize R. viscosissimum and R. lacustre as agents in the rapid intensification and spread of pine infection. While this tendency has been observed upon only one of fifteen areas, it must nevertheless serve as an indication that the period during which stream type eradication will be effective in retarding the spread and intensification of pine infection will not continue for many years. This fact should be interpreted to mean that the stream type eradication program should be pushed to completion at the earliest possible moment, and that upland type eradication should then be undertaken upon a large scale.

During the calendar year of 1930 the Western Branch of the Office of Blister Rust Control operated upon the basis of funds available from two Federal fiscal years, as follows:

For the entire fiscal year 1930 the applicable appropriation was "30133.14, Salaries and Expenses, Bureau of Plant Industry, Blister Rust Control, 1930" in the amount of $238,195 for western blister rust control work. From this appropriation funds in the amount of $65,442.19 were allotted for the period January 1, 1930 to June 30, 1930 as follows, together with $10,000 additional which was made available from funds originally allotted for eastern blister rust control work:

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During the calendar year of 1930 the Western Branch of the Office of Blister Rust Control operated upon the basis of funds available from two Federal fiscal years, as follows:

For the entire fiscal year 1930 the applicable appropriation was "30153.14, Salaries and Expenses, Bureau of Plant Industry, Blister Rust Control, 1930" in the amount of $238,195 for western blister rust control work. From this appropriation funds in the amount of $18,451.14 were allotted for the period January 1, 1930 to June 30, 1930 as follows together with $17,000 additional which was made available from funds originally allotted for eastern blister rust control work:

Project	For the Period 1/1/30 to 6/30/30
A. Delaying spread of blister rust	
1. Eradication of cultivated black currants in California..	$1,442.68
2. Field surveys in northwestern states to determine location of dangerous centers of pine infection and to follow the natural advance and establishment of blister rust in the northern area................	7,526.23
3. Field surveys in Oregon............................	1,214.30
B. Development and application of local control	
1. Federal lands in Washington, Idaho and northwestern Montana..	18,427.85
2. Local control on state and private lands in Idaho, two dollars for dollar cooperation between Federal Government and timber owners........................	23,527.80
3. Studies of local control and recheck of previously eradicated areas, Oregon............................	3,531.64
4. Studies of local control and its costs in California	3,702.06
5. Control reconnaissance and Ribes survey, California sugar pine areas......................................	1,531.20
C. Experimental work on chemical eradication of Ribes and studies on Ribes ecology..............................	17,934.83
D. Educational work..	2,763.60
E. Field supervision, maintenance of field office, miscellaneous supplies..............................	14,630.00
Total..........................	$96,462.19

From the total appropriation of $[illegible]33,195 for western blister rust control work for the entire fiscal year 1930, the sum of $22,155 was allotted to the Office of Forest Pathology for investigative work. Other miscellaneous allotments for the entire fiscal year were as follows: General control (maintenance of Washington Office) $19,710; to Office of Mycology $540; 1% Bureau Reserve $2,165.

From July 1, 1930 to December 31, 1930 the applicable appropriation was "31133.14, Salaries and Expenses, Bureau of Plant Industry, Blister Rust Control, 1931" in the amount of $238,195 (for the entire fiscal year 1931) allotted as follows:

Project		For the Period 7/1/30 to 6/30/31
A. Delaying spread of blister rust		
1. Field surveys in northwestern states to determine location of dangerous centers of infection and to follow the natural advance and establishment of blister rust in the northern area......................................		$17,718.32
2. Field surveys in Oregon.........................		2,600.00
3. Field surveys in California.....................		4,820.00
B. Development and application of local control		
1. Federal lands in Washington, Idaho and northwestern Montana................................		27,092.62
2. Local control on state and private lands in Idaho, two dollars for one dollar cooperation between Federal Government and timber owners....		40,000.00
3. Local control on state lands, Montana...........		1,000.00
4. Studies of local control and recheck of previously eradicated areas, Oregon.............		5,345.00
5. Studies of local control and its costs in California......................................		12,212.00
6. Control reconnaissance and Ribes survey, California sugar pine areas.....................		5,689.00
C. Investigative work, Office of Forest Pathology.....		22,155.00
D. Experimental work on chemical eradication of Ribes and studies on Ribes ecology......................		39,461.66
E. Educational work..................................		5,950.00
F. Field supervision, maintenance of Spokane office, miscellaneous supplies............................		27,526.40
G. Miscellaneous		
General control...............	$19,710.00	
Mycology......................	550.00	
2% Departmental Reserve.......	2,200.00	
1% Bureau Reserve.............	2,165.00	
Special Treasury Reserve......	2,000.00	26,625.00
Total......................		$238,195.00

From the appropriation "31133.25, Salaries and Expenses, Bureau of Plant Industry, Barberry Eradication, 1931" the sum of $6,500 for the entire fiscal year 1931 was allotted to the Western Branch of the Bureau.

Office of Blister Rust Control for experimental work in the eradication of barberry by chemicals. This work was conducted in connection with the experimental work on the chemical eradication of Ribes.

The organization of the work and the grouping of personnel followed the system in use in 1929. The majority of the employees were permanently headquartered at Spokane and were at the Spokane office when not engaged upon field assignments. The only exceptions to this general rule were in the cases of men whose special duties made it necessary for them to work elsewhere. The following is the permanent western personnel which was employed during the period covered by this report:

1. Supervisory

a. In charge of Western Branch Office, S. N. Wyckoff, Senior Pathologist.

2. Project Leaders

a. Ribes Ecological Studies. W. A. Rockie, Assistant Pathologist, (transferred to Bureau of Soils effective 9/1/30), assisted by J. L. Bedwell, Assistant Pathologist (transferred to Forest Pathology 6/2/30).

b. Experimental Ribes Eradication, Montana. *C. C. Strong, Associate Forester; C. H. Johnson, Associate Pathologist in immediate charge, assisted by D. W. Nelson, Junior Forester (resigned 4/10/30); and H. F. Geil, Agent.

c. Cooperative Local Control, Idaho. *C.C. Strong, Associate Forester, assisted by B. A. Anderson and W. G. Guernsey, Junior Foresters; H. E. Swanson, H. J. Hartman, G. M. Whiting, H. E. Crossley (transferred to Plant Quarantine and Control Administration 10/1/30), and C. O. Peterson (resigned 6/2/30), Agents.

d. Cooperative Local Control, National Parks, Washington. *C.C.Strong, Associate Forester, assisted by W. C. Riley, Junior Forester.

e. Field Studies in Methods and Equipment. *C. C. Strong, Associate Forester, assisted by H. E. Swanson, B. A. Ganoung (transferred to Plant Quarantine and Control Administration 3/1/30), and J. F. Breakey, Agents.

*For purposes of coordination and standardization of the various eradication projects (b,c,d and e) in the Inland Empire white pine belt, these were all placed under the supervision of C. C. Strong, Associate Forester.

office of Blister Rust Control for experimental work in the eradication of [illegible]. This work was conducted in connection with the experimental work on the chemical eradication of Ribes.

The organization of the work and the grouping of personnel followed the system in use in 1929. The majority of the employees were permanently headquartered at Spokane and were at the Spokane office when not engaged upon field assignments. The only exceptions to this general rule were in the cases of men whose special duties made it necessary for them to work elsewhere. The following is the permanent western personnel which was employed during the period covered by this report:

1. Executive

a. In charge of Western Branch Office, S. N. Wyckoff, Senior Pathologist.

2. Project Leaders

a. Ribes Ecological Studies, W. A. Rockie, Assistant Pathologist, (transferred to Bureau of Soils effective 9/1/30), assisted by J. L. Mielke, Assistant Pathologist (transferred to Forest Pathology 9/1/30).

b. Experimental Ribes Eradication, Montana, *C. C. Strong, Associate Forester; C. R. Jensen, Associate Pathologist in immediate charge, assisted by D. R. Nelson, Junior Forester (resigned 6/10/30); and C. E. Hall, Agent.

c. Cooperative Local Control, Idaho, *C. C. Strong, Associate Forester, assisted by E. L. Anderson and W. E. Garnsey, Junior Foresters; E. E. Swanson, H. J. Hartman, E. C. Whiting, C. E. Crosley (transferred to Plant Quarantine and Control Administration 10/1/30), and C. O. Peterson (resigned 9/9/30), Agents.

d. Cooperative Local Control, National Parks, Washington, *C. C. Strong, Associate Forester, assisted by R. C. Riley, Junior Forester.

e. Field Studies in Methods and Equipment, *C. C. Strong, Associate Forester, assisted by H. R. Offord, L. A. Swanson (transferred to Plant Quarantine and Control Administration 5/1/30), and J. F. Breakey, Agents.

*For purposes of coordination and simplification of the various eradication projects (b, c, d and e) in the Inland Empire white pine belt, these were all placed under the supervision of C. C. Strong, Associate Forester.

f. Educational Work, Kermit Miller, Agent, assisted by Miller Cowling, Agent.

g. Studies on Spread of the Rust and Damage to Pine. H. N. Putnam, Associate Pathologist, assisted by E. L. Joy, Junior Forester; R. E. Myers and C. M. Chapman, Agents.

h. Experimental Chemical Eradication. H. R. Offord, Agent, assisted by R. P. d'Urbal, Assistant Chemist; G. R. Van Atta, Mrs. I. E. Webber, George E. Draper, Louis S. Keyser, Clarence R. Quick, Fred F. Staat, Robert W. Vance and Jack A. Vogtmann, Agents; and Miss Frances Greenfield, Stenographer.

3. State Leaders

a. Montana, C. H. Johnson, Assistant Pathologist.

b. Oregon, L. N. Goodding, Associate Pathologist, assisted by Miss D. L. Anderson, Agent.

c. California, G. A. Root, Associate Pathologist, assisted by project leader W. V. Benedict, Assistant Forester, with his assistants, T. H. Harris, Junior Forester (Eradication), and D. R. Miller, Junior Forester (Reconnaissance); F. A. Patty, Assistant Pathologist (Ribes Ecology); Stenographic work performed by Miss M. J. Preitkis, Agent.

4. Clerical Work

Roy Calhoun, Junior Administrative Assistant (Transferred to Barberry Eradication 2/1/30).
R. L. MacLeod, Agent, assisted by A. H. Glasgow, Agent.
Miss M. L. McWold, Senior Clerk and Temporary Special Disbursing Agent, assisted by Mrs. E. M. Jump, Clerk and Mrs. M. C. Dowdy, Clerk.
Mrs. L. E. Klatt, Clerk
Mrs. E. K. Anderson, Junior Typist
Miss Catherine Ryan, Junior Clerk-Stenographer,
Miss Alice M. Fellows, Under Clerk-Typist (Transferred Veterans' Bureau 5/10/30).
Miss Marie V. Lynch, Under Clerk-Typist.

5. Collaborators

H. D. Barss, Corvallis, Ore.
Dr. J. P. Bennett, Berkeley, Calif.
Dr. Carl C. Epling, Los Angeles, Calif.

5. Collaborators (Contd)

A. O. Garrett, Salt Lake City, Utah
Dr. T. H. Goodspeed, Berkeley, Calif.
Dr. D. R. Hoagland, Berkeley, Calif.
Dr. E. E. Hubert, Moscow, Idaho
B. O. Longyear, Ft. Collins, Colorado
Rutledge Parker, Missoula, Montana
F. P. Sipe, Corvallis, Ore.

3. Collaborators (cont.)

A. O. Garrett, Salt Lake City, Utah
Dr. T. E. Rawlins, Berkeley, Calif.
Dr. D. E. Gonzalez, Berkeley, Calif.
Dr. E. T. Hubert, Moscow, Idaho
B. O. Longyear, Ft. Collins, Colorado
Rutledge Parker, El Paso, Texas
F. P. Sipe, Corvallis, Ore.

BLISTER RUST CONTROL WORK IN MONTANA
1930

Blister rust control activities in Montana were continued as a cooperative project between the Bureau of Plant Industry and the Montana Department of Agriculture, Montana Forestry Department, School of Forestry University of Montana, Northern Montana Forestry Association, and the Blackfoot Protective Association. There is given below the amendment to the basic memorandum of understanding, which was drawn up to cover the cooperative work for the fiscal year 1931 beginning July 1, 1930:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
MONTANA STATE DEPARTMENT OF AGRICULTURE - - - MONTANA STATE FORESTRY DEPARTMENT - - - THE SCHOOL OF FORESTRY, UNIVERSITY OF MONTANA - - - and the NORTHERN MONTANA FORESTRY ASSOCIATION

Cooperative Work in Controlling White-Pine Blister Rust
in
MONTANA

* * *

Paragraph F-6 of the Memorandum of Understanding described above contains the following:

> "For the fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $6,000, the Montana State Department of Agriculture approximately $5,000, the Montana State Forestry Department approximately $1,200, the School of Forestry, University of Montana, approximately $300, and the Northern Montana Forestry Association shall contribute in value approximately $1,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that the Blackfoot Protective Association will be added to those agencies who are cooperating to secure the control of white-pine blister rust in Montana and that for the fiscal year ending June 30, 1931, there will be contributed in value by the Montana State Department of Agriculture approximately $4,000, by the Montana State Forestry Department approximately $1,700, by the School of Forestry, University of Montana, approximately $300, by the Northern Montana Forestry Association approximately $1,000, by the Blackfoot Protective Association

approximately $1,000, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister-Rust Control, approximately $11,000 in connection with cooperative blister-rust-control work in Montana.

Date:		Signature:
	(s)	A. H. Stafford Commissioner, Montana Department of Agriculture
July 26 - 30	(s)	Rutledge Parker State Forester, Montana Forestry Department
	(s)	T. C. Spaulding Dean, School of Forestry, University of Montana
June 4, 1930	(s)	A. L. Boorman Secretary, Northern Montana Forestry Association
	(s)	Roscoe Haines Secretary, Blackfoot Protective Association
1/9/31	(s)	Wm. A. Taylor Chief, Bureau of Plant Industry

RIBES ERADICATION, SAVENAC NURSERY, HAUGAN, MONTANA

By

C. H. Johnson
Associate Pathologist

Our efforts to reduce the protection zone around Savenac Nursery to a Ribes free state are gradually taking shape. A measureable degree of success has already been attained toward this end and up to the present time no difficulties have been encountered which in any way threaten defeat of our plans.

At Haugan the following methods of Ribes eradication have been practiced: (1) chemical spraying (power and knapsack), (2) hand pulling, (3) knapsack spraying followed by broadcast burning, and (4) cutting, piling and burning brush without spraying. Costs must always be considered in the practical application of any method of Ribes eradication. The following figures are on a comparable basis since they represent costs arrived at during the initial and experimental stages of each operation:

Method	Year	Cost Per Acre
Hand eradication on minor drainages Ribes light to medium	1928	$13.513
Hand eradication on sample plots Ribes medium to heavy	1928	55.00
Chemical eradication Ribes medium to heavy	1928	29.082
Combined hand and chemical excluding the cost of $55.00 per acre on sample plots	1928	20.285
Hand pulling, spraying and burning Ribes medium and heavy	1929	13.675
Cutting, piling and burning brush	1930	68.96

A comparison of figures indicates that the method employed in 1929 shows the lowest cost of operation in medium and heavy concentrations of Ribes.

Cutting, piling and burning brush as practiced in 1930 is a most expensive method and is justifiable only when it becomes necessary to give immediate protection to a nursery or some similar area where no chance can be taken from attack by the blister rust. The greater portion of the area from which the brush was removed this year has been fenced and will be converted into a pasture for grazing Government pack stock. The cost of Ribes suppression will eventually be balanced by values derived from grazing.

Dense brush sprayed and burned August 1929. Brome grass planted April 1930. Some Ribes sprouts from crowns but no germination of seedlings. Brush dead and decaying.

Brush sprayed and burned August 1[illegible]. S[illegible] to Red Canary grass May 1[illegible]. Dense mass of R. inerme and associated brush eliminated.

Brush sprayed 1928. Burned July 1929. Timothy and Red Top planted April 1930. Extremely heavy germination of R. inerme occurred with grass. Plot heavily grazed but no eradication performed. Inspection October 1930 revealed practically 100% extermination or suppression of R. inerme seedlings.

Severe burn in heavy windfall and dense R. inerme. Complete destruction of all bushes and seeds. Clover was planted April 19[illegible]. Good germination was secured, but died after attaining a growth of about 1 inch.

Along the main drainages in the vicinity of Cavenac Nursery approximately 150 acres, which are classed as permanent Ribes sites, have been cleared and burned and are ready for the next treatment which, according to plans and preparation, should be sowed to grass to form a permanent turf. Experiments have been conducted with the following grasses: timothy, red top, clover, Kentucky blue grass, red canary grass, slender wheat and a brome grass. An excellent turf was established by a mixture of timothy and clover. Such a combination can be used successfully along the streams at Haugan. Blue grass is slow in getting started, but forms a good sod. The ingredients of most mixtures should contain some blue grass. Red canary grass made the most vigorous growth of any grass sown, but it is a new species which must demonstrate its ability to maintain itself and spread. It withstands drought very well. The slender wheat and brome grass have readily germinated on the drier sites. Early observations indicate they would not spread so well as the other grasses. Clover and timothy are the grasses most widely grown in the region.

All grasses sown during the 1930 season are apparently supplanting Ribes. There is also evidence of Ribes suppression. In August, 1929 an area classed as heavy R. inerme and brush was fired. In the spring of 1930 timothy was sown on a 1/20th acre plot. The outcome was a good stand of grass and total absence of R. inerme seedlings. Three sprouts from roots were found. On a similar area following a medium burn timothy and clover seed were sown. An extremely heavy germination of Ribes appeared with the grass. Toward the end of the season all clusters of Ribes seedlings had disappeared. In October only 22 Ribes seedlings were in evidence. The plot was well grazed, but also well protected by a medium stand of dead willow. It is hardly possible that all clusters of R. inerme seedlings could have been eradicated by stock. There was stronger evidence of Ribes suppression.

The cost of removing brush from a permanent Ribes site in the future will undoubtedly be that cost necessary to kill a good portion of the brush by spraying and at the same time raise the inflammability of the brush sufficiently high to insure destruction by burning.

PERMANENT RIBES SUPPRESSION AT SAVENAC NURSERY, HAUGAN, MONTANA

By
Harry F. Geil
Agent

INTRODUCTION

Control work at the Savenac Nursery, Haugan, Montana, was not strictly a Ribes re-eradication job but a combination of Ribes re-eradication and clean-up work. Part of the area had been partially cleared of Ribes in 1928 and reworked in 1929, and a part of the re-eradication consisted of burning over the dense concentrations of brush and Ribes that had been sprayed with chemicals in 1928. Therefore plans were made to cover a wide enough area in such a manner that the nursery's 5-needled pines would be fully protected from any danger of infection by blister rust. Of course it is known that follow-up work will have to be done periodically in the future to take care of seedlings and other re-growth of Ribes that will come in following soil disturbance.

The season's work consisted of going over the area previously worked extending the protection zone to a mile beyond the nursery limits on all stream type, and of cutting and piling the brush on areas covered with dense concentrations of brush and Ribes.

Although data were taken on all Ribes pulled, such information is of little importance on this job now, as the number and species of Ribes and the number of feet of live stem remaining is what determines the degree of protection.

The results of the 1929 burning indicated very clearly that it is a successful method of eliminating dense concentrations of Ribes from areas where brush is thick. Therefore it was decided to clear certain stream type areas adjacent to the nursery of all brush. Arrangements were made with the Forest Service whereby they cooperated in this brush clearing operation.

BRUSH CLEARING

The cutting and piling of brush was started in April with a small crew which was gradually increased to 24 men. At the end of June this work was suspended until September 1, after which a crew of six men was employed for about two weeks.

The men employed at this work were secured locally, being ranchers, woodsmen and men whom the Forest Service employ on fire protection during the summer.

W.629 - Area on Big Creek showing dense concentrations of R. petiolare

W.638 - Area on Big Creek showing the large brush cut and piled and the small brush sprayed with chemicals preparatory to burning.

The areas from which brush was cut and piled are as follows: Savenac Creek from the St. Regis River to the north boundary of the nursery, Big Creek from the C. M. & St. P. Ry., to about one-half mile up the creek and on the St. Regis River from Haugan west. An area of 70 acres was cleared.

RIBES ERADICATION

From June 15 to June 30, 8 men were employed on Ribes eradication, after which time 4 more were added. These men were kept on Ribes eradication work until the end of August when 6 of them were transferred to the brush-cutting operation. The remaining 6 finished up the regular Ribes eradication and then reworked some of the area where checking had shown the work to have been least satisfactory.

Pulling the remaining Ribes from the lower Savenac Creek after the brush had been cut was not a difficult job, and a high degree of efficiency was obtained. On St. Regis River and Big Creek where fire had gone through in 1910, working conditions were good on account of the ground being comparatively free of brush. However, a great deal of time and care was required in going over this ground due to the great number of seedlings on the area.

[illegible] — An area adjacent to and similar to [illegible] with brush cut and piled.

W.716 - Typical stream type on Savenac Creek showing the dense growth of willows and alders which average 20 feet in height. Heavy concentrations of R. petiolare and R. inerme form the understory.

W.583 - An area adjacent to and similar to W.716 with brush cut and piled.

TABLE NO. 1

RESULTS OF RIBES RE-ERADICATION

Area	Acres	Ribes pulled: R. petiolare: Seed-lings	Others	Total	Per Acre	R. inerme: Seed-lings	Others	Total	Per Acre	Totals: Seed-lings	Others	Total	Per Acre
Savenac Creek	131.6	2,880	3,385	6,265	47.6	10,476	19,373	29,849	226.8	13,356	22,758	36,114	274.4
St.Regis River	284.6	770	2,880	3,650	12.8	43,367	36,684	80,051	281.3	44,137	39,564	83,701	294.1
Big Creek	72.7	996	2,438	3,434	47.2	39,803	10,801	50,604	696.1	40,799	13,239	54,038	743.3
Timber Creek	27.0	50	127	177	6.5	4,079	2,278	6,357	235.5	4,129	2,405	6,534	242.0
Dry Creek	48.3	3,137	3,889	7,026	145.4	3,451	9,327	12,778	264.6	6,588	13,216	19,804	410.0
Totals or Ave.	564.2	7,833	12,719	20,552	36.4	101,175	78,463	179,638	318.4	109,009	91,182	200,191	354.8

TABLE NO. 2

COST OF OPERATION

Cost Analysis

Expense Items	Operation		
	Re-eradication	Brush Clearing	Totals
Salaries	$3,026.94	$2,069.29	$5,096.23
Subsistence	1,073.45	627.29	1,700.74
Transportation	114.41	32.52	146.93
Equipment	38.48	27.86	66.34
Miscellaneous	16.72	1.55	18.27
Totals	$4,270.00	$2,758.51	$7,028.51

MAN DAYS AND COST PER ACRE

	Man Days	Acres	Cost	Per Acre
Re-eradication	305.5	564.2	$4,270.00	$ 7.57
Brush Clearing	642.5	*40.0	$2,758.51	$ 68.96

*30 acres more were cleared. This work was paid for by the Forest Service.

COOPERATIVE LOCAL CONTROL
MONTANA, 1930
by
C. H. Johnson
Associate Pathologist

INTRODUCTION

The year 1930 marks the initial undertaking and attempt to cooperatively protect white pine from attack by the blister rust. The work was conducted jointly by the State of Montana and the United States Department of Agriculture on state and federal lands and extended over the period from June 16 to August 22.

PURPOSE

(1) To initiate cooperative local control measures for the protection of white pine stands in Montana. (2) To determine by practical work the cost of such protection. (3) To develop a trained personnel for future operations.

LOCATION OF WORK

The eradication of stream type Ribes was done in T. 28 N., R. 19 W., and T. 27 N., R. 19 W., Montana Principal Meridian, and particularly in the drainages of Echo Creek, Noisy Creek, Krause Creek, Birch Creek, Rock Creek, Station Creek. In addition, some eradication work was done along old logging roads and on a camp and mill site.

METHOD EMPLOYED

The method of eradication consisted of hand pulling. A crew of five men made up the unit, with four men working in line and the fifth man working behind the line and checking all the ground covered. A string line was used as a guide to prevent overlapping of ground worked.

DESCRIPTION OF AREA AND WORKING CONDITIONS

The stand is classed as a white pine-larch-Douglas fir type, with white pine predominating or in excess of 15% of the stand. Areas of mature lodgepole exist, but this species has reached its maximum growth and is being replaced by white pine, ranging from reproduction to the pole stage. The principal Ribes species eradicated were R. lacustre and R. viscosissimum. The stream type could not be classed as particularly brushy, and as a whole represented very favorable working conditions. R. lacustre averaged from 50 to 100 per acre along streams and from 100 to 500 per acre along roads and on an area classed as a camp and mill site.

RESULTS

The project, although small, has given protection to a fine stand of white pine covering approximately 16,000 acres. The cost of protection for the general region has been determined. Public sentiment in favor of protection against blister rust has been awakened.

TABLE NO. 1

COST OF COOPERATIVE BLISTER RUST CONTROL, MONTANA, 1930

Crew Organization	Salaries	Sub-sis-tence	Trans-por-tation	Supplies & Equipment	Total Cost	Acreage Worked	Cost Per Acre Worked
C.H. Johnson J.L.Ashbaugh and crew of 4 men	$1,155.45	$371.79	$31.90	$14.09	$1,573.19	472	$3.333

TABLE NO. 2

RESULTS OF COOPERATIVE RIBES ERADICATION MONTANA, 1930

Area	Acres	Ribes Pulled - By Species					
					Per Acre		Total
		R. visc.	R. lac.	Total	R. visc.	R. lac.	Per Acre
Noisy Creek	70	1,811	12,889	14,700	25.9	184.1	210.0
Echo Creek	96		5,280	5,280		55.0	55.0
Birch Creek *	40		6,520	6,520		163.0	163.0
Rock Creek *	16		2,600	2,600		225.0	225.0
Krause Creek	42		6,426	6,426		153.0	153.0
Station Creek *	24		3,600	3,600		150.0	150.0
Camp & Mill site	40	73	13,527	13,600	1.8	338.2	340.0
Roads and Trails	144	732	25,813	26,545	5.1	179.9	185.0
Totals or Ave.	472	2,616	76,755	79,371	5.5	156.3	168.2

*The acreage worked on Birch, Station and Rock Creeks lies within the Flathead National Forest.

SCOUTING FOR BLISTER RUST, MONTANA, 1930

By
C. W. Johnson
Associate Pathologist

The nature of Ribes infection in Montana would indicate that the rust was coming in from some distant infection center or points of infection. All infections found to date have been very light, consisting of five or six leaves to a bush. The general region covered by white pine reconnaissance was again scouted, with rather intensive search in the vicinity where Ribes eradication was being conducted. Four infections were found this season and all within a distance of 1-1/2 to 3 miles from Savenac Nursery. As a result of intensive scouting in the general region of Haugan the inference is that the blister rust is becoming entrenched on that portion of the Lolo National Forest drained by the St. Regis River and the southern portion of the Cabinet Forest drained by the Clarks Fork River.

BLISTER RUST CONTROL WORK IN IDAHO
1930

Blister rust control activities in Idaho were continued as a cooperative project between the Bureau of Plant Industry and the Idaho State Department of Agriculture, University of Idaho, Idaho State Board of Forestry, Potlatch Timber Protective Association, Clearwater Timber Protective Association, Coeur d'Alene Timber Protective Association, Pend Oreille Timber Protective Association and the Priest Lake Timber Protective Association. There is given below the amendment to the basic memorandum of understanding, which was drawn up to cover the cooperative work for the fiscal year 1931 beginning July 1, 1930:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
IDAHO STATE DEPARTMENT OF AGRICULTURE - - - UNIVERSITY OF IDAHO - - - IDAHO STATE BOARD OF FORESTRY - - - POTLATCH TIMBER PROTECTIVE ASSOCIATION - - - CLEARWATER TIMBER PROTECTIVE ASSOCIATION - - - COEUR D'ALENE TIMBER PROTECTIVE ASSOCIATION - - - PEND OREILLE TIMBER PROTECTIVE ASSOCIATION - - - and the PRIEST LAKE TIMBER PROTECTIVE ASSOCIATION

Cooperative Work in Controlling White-Pine Blister Rust in

IDAHO

* * *

Paragraph J-6, of the Memorandum of Understanding described above contains the following:

> "For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $78,000 to the support of this cooperative work, the Idaho State Department of Agriculture shall contribute in value approximately $1,100, the University of Idaho approximately $4,000, the Potlatch Timber Protective Association approximately $3,800, the Clearwater Timber Protective Association approximately $3,800, the Coeur d'Alene Timber Protective Association approximately $3,800, the Pend Oreille Timber Protective Association approximately $3,800, and the Priest Lake Timber Protective Association approximately $4,340; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provisions, it is mutually agreed that for the fiscal year ending June 30, 1931, there will be contributed in value by the Idaho State Department of Agriculture approximately $2,000.00; by the University of Idaho approximately $4,000.00; by the Potlatch Timber Protective Association approximately $10,000.00; by the Clearwater Timber Protective Association approximately $10,000.00; by the Coeur d'Alene Timber Protective Association approximately $2,300.00; by the Pend Oreille Timber Protective Association approximately $2,300.00; by the Priest Lake Timber Protective Association approximately $2,300.00; and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister-Rust Control, approximately $75,000.00 in connection with cooperative blister-rust-control work in Idaho.

Date:		Signature:
June 5th, 1930	(s)	John B. Welch Commissioner, Idaho State Department of Agriculture.
Sept. 8, 1930	(s)	F. G. Miller University of Idaho
June 21, 1930	(s)	Ben A. Bush State Forester, Idaho State Board of Forestry
Sept. 4th, 1930	(s)	A. A. Laird President, Potlatch Timber Protective Association
Sept. 22d, 1930	(s)	Theo. Fohl Secy-Treas. Clearwater Timber Protective Association.
Oct. 11th, 1930	(s)	C. O. Graue Secretary, Coeur d'Alene Timber Protective Association
Oct. 17, 1930	(s)	T. I. Greer Secretary, Pend Oreille Timber Protective Association.
Oct. 25, 1930	(s)	J. S. Barron Secretary, Priest Lake Timber Protective Association
Nov. 4, 1930	(s)	Wm. A. Taylor Chief, Bureau of Plant Industry

RIBES ECOLOGY IN THE INLAND EMPIRE
1930

By
C. R. Waters
Agent

INTRODUCTION

The important role which the Ribes ecology work should play in the control program of the blister rust is apparent. To meet and overcome a situation effectively it is first necessary to know the various conditions which control this situation. In the case of the present problem this means a better understanding of the Ribes and their relation to the environmental influences which surround them. This involves a study of the factors which control their germination and growth, dissemination and general distribution. An exhaustive treatment of such factors should aid in perfecting efficient means of eradication and possibly the ultimate establishment of a management plan of forestry whereby the germination and growth of Ribes will be inhibited.

During the year 1930, four distinct studies were in progress. Two of these were continuations from previous years and two were initiated during the past season. They are as follows:

Controlled plot studies.
Duff mantle investigations.
Seed storage study.
Ribes seed germination tests.

Some of these studies have been carried on in part in the laboratories of the University of Idaho, with the cooperation and assistance of several members of the faculty. To them and to the University administration are due thanks for laboratory facilities and helpful assistance.

The methods and results of these several studies will be taken up individually in the order named above.

CONTROLLED PLOT STUDIES

A. Purpose

This project was designed with the purpose of investigating experimentally whether viable seeds of Ribes are present in or beneath the forest duff of different ages, or whether these viable seeds from which Ribes develop on forest areas are recently deposited through some disseminating agency such as wind, water, birds or rodents, also to determine under what conditions these seeds germinate and to what extent such plants survive.

B. Methods

These studies were initiated in 1927 and 1928 and are described on pages 131-134 of the 1927 annual report and page 28 of the 1928 report.

C. Results

The final results of these studies are not yet organized into a form suitable to be presented in this report so that an attempt has been made only to show the continued records of current germination and survival on these plots. This is a continuation of the records as submitted on pages 28-31 of the 1929 report.

Graph No. 1, which shows the effect of different disturbances of the organic mantle on the germination and survival of volunteer *Ribes viscosissimum*, is a continuation of Graph No. 1 as shown on page 27 of the 1929 annual report.

As shown in the graph, no important changes occurred in the Ribes population of the several plots during the season of 1930. In practically all of the cases, there has been a gradual diminution in the number of living plants with the new germinations being insufficient to increase the total.

No appreciable increase was noted in the number of seedlings at the time of the first or spring examination for 1930 even in those plots which were not burned. This is in contrast to the results obtained for the same period for 1929.

The heavy burned plots show the most constant results since there have been very few deaths or germinations since the summer of 1929. This of course is to be expected since the number of Ribes seeds remaining on the plots was low following the burning process and the resulting germinations encountered very little competition.

The results at the end of the third year seem to confirm the conclusions reached at the end of 1929; namely, that in the burned plots, germination was almost complete the first year. The unburned plots, however, showed heavy additional germination the second year with but very little the third.

Graph No. 2 shows a comparison of the Ribes germination in the three differently protected blocks. This is also a continuation of Graph No. 2 as shown on page 29 of the 1929 annual report.

A comparison of the results obtained from these three differently protected blocks seems to indicate that the methods of protection accorded these blocks have had little or no influence on the numbers of Ribes which have germinated therein; at least during the three years in

which the studies have been carried on. The presence of greater numbers of Ribes in the fully protected block III, i.e., from which both birds and rodents have been excluded, has already been explained and seemingly has nothing to do with the type of protection.

The significance to be attached to the results of this set of studies seems doubtful since they have not been extended over a long enough period of years. They do show definitely that during the three years, few, if any, viable seeds have been introduced into the unprotected plots through outside agencies such as rodents or birds.

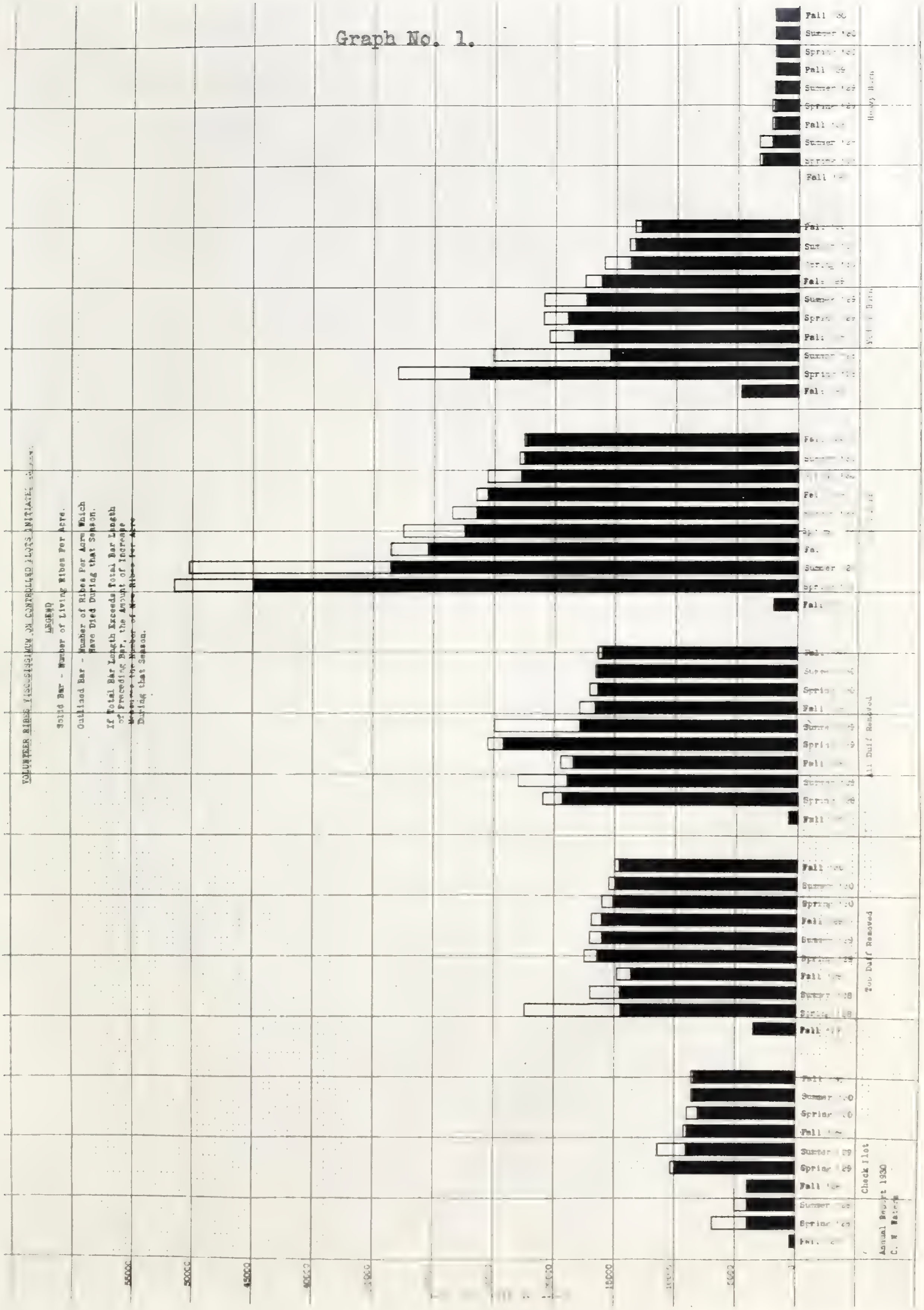
When one considers, however, the limited area covered by these blocks and the improbability of an appreciable number of seeds being introduced therein during such a brief period as three years, it becomes evident that any relation which might exist between birds and rodents and Ribes seed dissemination remains an unknown, yet possibly a very important factor in the control program.

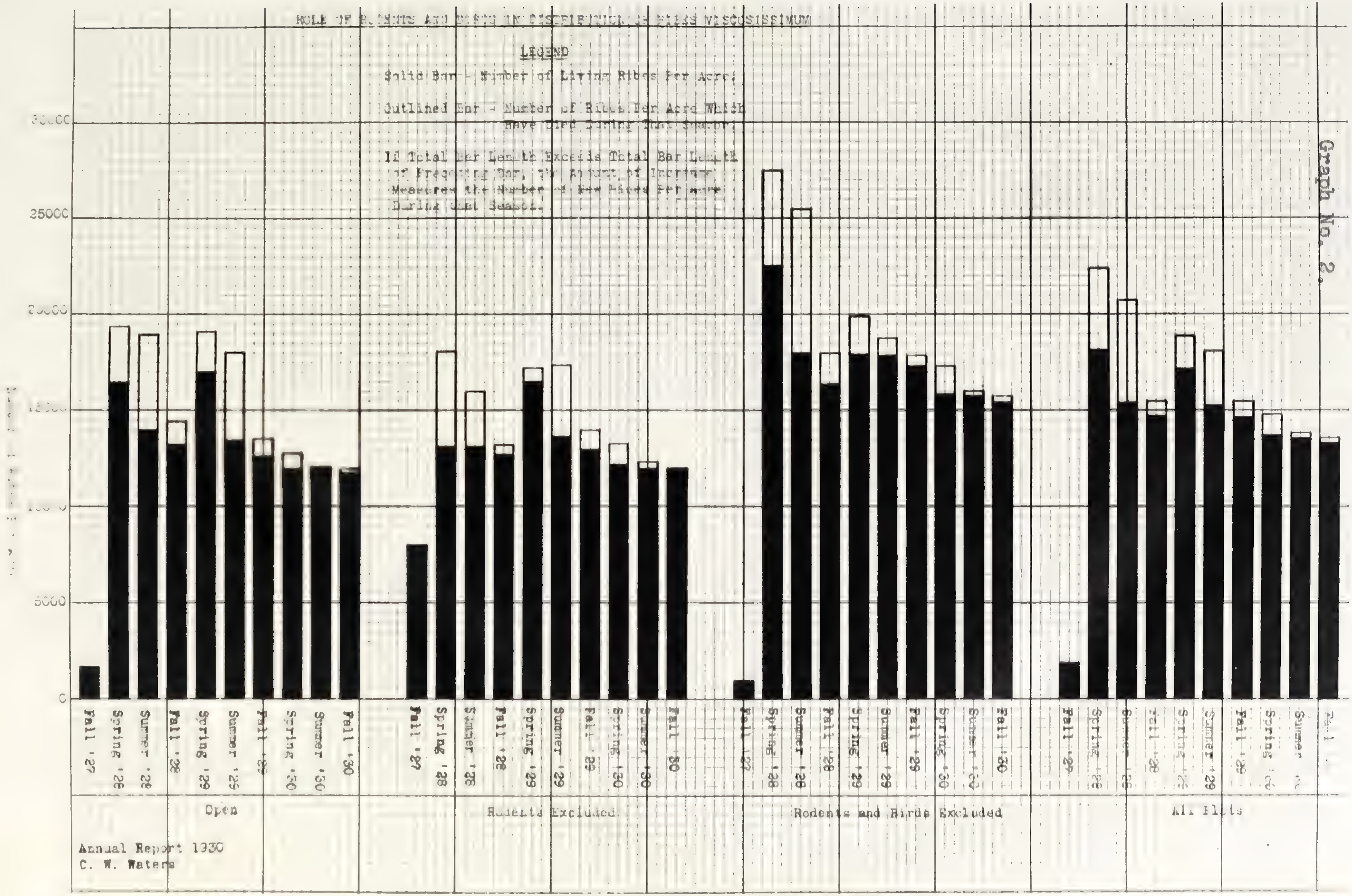
when the studies have been carried on. The presence of greater numbers of lilac in the fully protected block III, i.e., from which both birds and rodents have been excluded, has already been explained and seemingly has nothing to do with the type of protection.

The significance to be attached to the results of this set of studies seems doubtful since they have not been extended over a long enough period of years. They do show definitely that during the three years, few, if any, viable seeds have been introduced into the unprotected plots through outside agencies such as rodents or birds.

When one considers, however, the limited area covered by these blocks and the improbability of an appreciable number of seeds being introduced therein during such a brief period as three years, it becomes evident that any relation which might exist between birds and rodents and lilac seed dissemination remains an unknown, yet possibly a very important factor in the control program.

Graph No. 1.


VOLUNTEER RIBES VISCOSISSIMUM ON CONTROLLED PLOTS INITIATED
LEGEND
Solid Bar - Number of Living Ribes Per Acre.
Outlined Bar - Number of Ribes Per Acre Which Have Died During that Season.
If Total Bar Length Exceeds Total Bar Length of Preceding Bar, the Amount of Increase Measures the Number of New Ribes Per Acre During that Season.
55000
50000
45000
10000
5000
Check Plot
Top Duff Removed
All Duff Removed
Annual Report 1930
C. W. Waters


Graph No. 2.
MUM
LEGEND
Solid Bar - Number of Living Ribes Per Acre.
If Total Bar Length
0
5000
25000
Fall '27
Spring '28
Summer '28
Fall '28
Spring '29
Summer '29
Spring '30
Summer '30
Fall '30
Open
Rodents Excluded
Rodents and Birds Excluded
Annual Report 1930
C. W. Waters

DUFF MANTLE INVESTIGATIONS

A. Purpose

The purpose of these studies was to measure the depths of the duff and humus layers of the organic soil mantle in various timber age classes of the white pine region of northern Idaho with the hope of determining the rate at which the formation of inorganic soils took place in these various age classes influenced by different factors such as slope, exposure and species constitution of the stands. With such information at hand it was hoped that a clearer picture would be presented as to the fate of such Ribes seeds as might be deposited in this organic mantle at any period or periods in the development of such mantle.

B. Methods

For this study the organic mantle was divided into two layers, the duff, consisting principally of needles and small twigs unaltered as to form but beginning to decay in the lower portion, and the underlying humus, made up of decomposed vegetable material which had largely lost its original physical and vegetable texture.

Sites were selected throughout the white pine region extending from the Forest Service Experiment Station at Priest River, Idaho on the north, to the Clearwater Forest on the south. These sites were selected to represent as many age classes as possible and a variety of situations with respect to slope, exposure, etc. Descriptive data were recorded for each site on Form 24 as appended.

The measurements were taken in each case at a spot which was comparatively free from twigs and coarse litter. This was done to prevent undue disturbance of the duff. A trench, about 3 feet long, was cut with a small hand axe, extending well below the mineral soil. This trench was cut as perpendicularly as possible along the one side but sloped off on the other side to facilitate the measurements. With a sharp instrument, commonly known as a vegetable chopper, the mantle was carefully trimmed back along the perpendicular side of the trench until it presented a smooth, clean surface.

A straight stick 36" long, marked off into 12" lengths, was laid on top of the duff along the edge of the cut surface and made firm to the surface by means of a hooked stick pushed into the soil. With calipers and rule, three measurements were made of the duff and humus at 12" intervals along the stick. This gave an average of three measurements for each site. These measurements were tabulated, as indicated on the following form No. 24.

TF-BRC #24 6/7/30 (Data Sheet)

DUFF MEASUREMENTS

Area No.______________ Date______________ Age Class ______________

Locality______________ Location of Area______________

____

Altitude______________ ft. Density of Stocking______________

Species - Composition______________

Exposure______________ Slope______________

Situation______________

Soil Moisture______________

Shaded______________ Partly Shaded______________ Open______________

Approx. proportion of each species of needle in duff mixture______________

____

Duff Layer	Depth Inches	Compact or Loose (C or L)	Moist or Dry (M or D)	Sound Partly Decayed or Decayed (S.P. or D)	Mycelium Present	Mixed with Mineral Soil (O or X)
1. Duff						
2. Humus						
3. Podsol						
Entire Layer to Mineral Soil						

Observer______________

2,120 measurements were made, involving eight distinct age classes with the number of measurements being distributed as equally as possible over these various age classes.

C. Results

These studies are summarized in Table No. 1 as follows: No attempt has been made at this time to analyse the results from the standpoint of various site situations or constitution of the stands.

TABLE NO. 1

DEPTH OF DUFF AND HUMUS LAYERS OF THE ORGANIC SOIL MANTLE IN THE WHITE PINE REGION OF NORTHERN IDAHO BY TIMBER AGE CLASSES

Timber Age Class	Number Samples Measured	Depth of Duff in Inches	Depth of Humus in Inches	Total Depth of Organic Layer in Inches
21-40	360	0.98	0.94	1.92
41-60	330	1.04	1.05	2.09
61-80	340	0.95	0.86	1.81
81-100	320	0.99	0.89	1.88
101-120	240	0.95	0.99	1.94
121-160	190	1.10	0.98	2.08
161-200	150	1.24	1.25	2.49
200+	190	0.99	1.33	2.32
Totals or Averages	2,120	1.03	1.04	2.07

From the results as shown in the above table, it is evident that there occur no important changes in the depth of either the duff or the humus layers during the development of a timber stand from the pole stage to maturity or beyond. The duff and humus layers, regardless of timber age classes, show little variation in depth beneath stands ranging from 20 to 200 years in age. Each layer averages about one inch in depth. This is somewhat at variance, but not in discord with the findings of Griffith, et al[1], in New England white pine areas.

This seems to indicate, then, that in this organic mantle there is at work a constant decomposition of the humus to mineral soil, of duff to humus, and a continued replenishment of the duff from the forest cover.

---

[1] The Evolution of Soils as Affected by the Old Field White pine-Mixed Hardwood Succession in Central New England.

which the 2,192 measurements were made, involving eight distinct age classes with the number of measurements being distributed as equally as possible over these various age classes.

C. Results

These studies are summarized in Table No. 1 as follows: No attempt has been made at this time to analyze the results from the standpoint of various site situations or constitution of the stands.

TABLE NO. 1

DEPTH OF DUFF AND HUMUS LAYERS OF THE ORGANIC SOIL MANTLE IN THE WHITE PINE REGION OF NORTHERN IDAHO BY TIMBER AGE CLASSES

Timber Age Class	Number Samples Measured	Depth of Duff in Inches	Depth of Humus in Inches	Total Depth of Organic Layer in Inches
21-40	225	0.96	0.91	1.82
41-60	250	1.04	1.00	2.04
61-80	245	0.96	0.86	1.81
81-100	300	0.99	0.93	1.95
101-120	291	0.98	0.92	1.94
121-140	170	1.12	0.97	2.08
141-200	190	1.34	1.07	2.45
200+	171	0.91	1.32	2.32
Totals or Averages	2,192	1.01	1.04	2.07

From the results as shown in the above table, it is evident that there occur no important changes in the depth of either the duff or the humus layers during the development of a timber stand from the pole stage to maturity or beyond. The duff and humus layers, regardless of timber age classes, show little variation in depth beneath stands ranging from 21 to 200 years in age. Each layer averages about one inch in depth. This is somewhat at variance, but not in discord with the findings of Griffith, et al[1], in New England white pine areas.

This seems to indicate, then, that in this organic mantle there is at work a constant decomposition of the humus to mineral soil, of duff to humus, and a continued replenishment of the duff from the forest cover.

[1] The Evolution of Soils as Affected by the Old Field White pine-Mixed Hardwood Succession in Central New England.

The production of duff and humus is necessarily small in the initial forest stages, attaining a quantity basis when the new forest cover is from ten to twenty years old. The lower portion of this duff decomposes fairly rapidly into humus which in turn becomes intimately associated with the mineral soil due to oxidation and the activity of various micro-organisms and fungi.

Therefore, the entire duff and humus mantle in a 40-year stand would represent for the most part the accumulation of the past twenty or twenty-five years, since the first 15 to 20 years of that stand produced very little of the organic mantle. In the succeeding one hundred years, as indicated by the figures, the accumulation of duff and humus with the corresponding decomposition of this into mineral soil goes on at a fairly uniform rate since the depth of the organic mantle does not change perceptably. Thus the actual materials which made a 2-inch layer in the 40-year stand must comprise not more than the basal half of the organic mantle at 65 years of age, not to exceed the basal third at 90 years of age, nor more than the basal fifth of the duff and humus layer when the stand is 140 years of age. By the time the stand attains the age of 160 to 200 years or more, the layer which was the entire 2-inch organic mantle at 40 years of age, has "melted down" until it is but a very thin layer at the base of the organic mantle.

Thus if it be true that Ribes do not grow and produce fruits in forest stands over 30 years of age, no new seeds could be contributed directly to the accumulation of the duff after such a period. Furthermore, if wind, water, rodents and birds play only a minor part, if any, in the dissemination of Ribes seeds, few if any seeds could be brought into such areas from the outside. Therefore, any Ribes seeds present in the organic mantle in stands over 30 years of age must be located in the first 30 years accumulation of such organic mantle.

Since the results of the measurements seem to indicate that this first thirty years of duff-humus accumulation gradually diminishes in thickness at the bottom of the organic mantle until at maturity it is merely a thin layer at the bottom of years of accumulation, any Ribes seeds present would necessarily be found in this lower layer.

Although the results of the controlled plot studies apparently substantiate this theory, it is evident that such evidence is of a circumstantial nature and should be supported by direct and undeniable facts. In other words, if Ribes seeds are present in this layer, it should be possible actually to find them. This leads to the next project that was initiated and carried on in a preliminary manner during the season of 1930.

The production of duff and humus is necessarily small in the initial forest stages, attaining a quantity basis when the new forest cover is from ten to twenty years old. The lower portion of this duff decomposes fairly rapidly into humus which in turn becomes intimately associated with the mineral soil due to oxidation and the activity of various micro-organisms and fungi.

Therefore, the entire duff and humus mantle in a 60-year stand would represent for the most part the accumulation of the past twenty or twenty-five years, since the first 15 to 20 years of that stand produced very little of the organic mantle. In the succeeding one hundred years, as indicated by the figures, the accumulation of duff and humus with the corresponding incorporation of this into mineral soil goes on at a fairly uniform rate since the depth of the organic mantle does not change perceptibly. Thus the actual materials which made a 2-inch layer in the 60-year stand must comprise not more than the basal half of the organic mantle at 85 years of age, and be passed the basal third at 70 years of age, nor more than the basal fifth of the duff and humus layer when the stand is 150 years of age. By the time the stand attains the age of 150 to 200 years or more, the layer which was the entire 2-inch organic mantle at 60 years of age, has "melted down" until it is but a very thin layer at the base of the organic mantle.

Thus if it be true that trees do not grow and produce fruits in forest stands over 60 years of age, no new seeds could be contributed directly to the accumulation of the duff after such a period. Perhaps, if wind, water, rodents and birds play only a minor part, if any, in the dissemination of alder seeds, few if any seeds would be brought into such stands from the outside. Therefore, any alder seeds present in the organic mantle in stands over 60 years of age must be located in the first 20 years accumulation of such organic mantle.

Since the results of the measurements seem to indicate that this first twenty years of duff-humus accumulation gradually dwindles down as the surface of the organic mantle until at maturity it is merely a thin layer at the bottom of years of accumulation, any alder seeds present would necessarily be found in this lower layer.

Although the results of the controlled plot studies apparently substantiate this theory, it is evident that such evidence is of a circumstantial nature and should be supported by direct and undeniable facts. In other words, if alder seeds are present in this layer, it should be possible actually to find them. This leads to the next project that was initiated and carried on in a preliminary manner during the summer of 1930.

SEED STORAGE STUDY

A. Purpose

These studies were planned and carried on in an effort to ascertain, if possible, the actual existence and exact location of stored Ribes seeds in the duff and humus layers in the various areas of the white pine region of northern Idaho. As the work began, it became evident that the progress of the work would not be materially slowed up if an exact count were kept of all seeds found in the soil. Hence, in the investigation, all seeds, both conifer and and non-conifer, were counted and tabulated but only the data on the non-coniferous seeds are recorded in the following report.

B. Methods

The original plan of procedure as begun and carried out during the early part of the studies, consisted in locating variously scattered sites representing, in so far as possible, the different age classes present in the areas. In these several areas a strip was selected, 80 inches in length and 8 inches wide. This strip was marked off into squares 8 inches on a side. Thus each strip yielded 10 squares arranged in linear formation.

With a wide-bladed knife each square was carefully cut around, the knife being pushed down below the level of mineral soil. With the same knife, the top layer, designated litter, was carefully peeled off the first square, placed in a paper sack and carefully labeled. The litter layer, represented a loose assemblage of twigs, needles and other debris.

Next, the second layer, the duff, was peeled off in the same manner and treated likewise. This duff layer extended down to the layer commonly known as humus. The humus layer was next peeled off, care being taken in this case to extend the collection some distance beyond the layer of mineral soil. In practically all cases the layers from a single square were 3 in number, although there were a few cases in which the humus layer was divided into two samples. These samples were designated as 1, 2 and 3, successively. The second block or square was collected in the same manner and so on for the ten squares of the strip. In labeling the various samples the strip number was indicated first; next came the block number and lastly, the sample. Thus, the first sample collected was called 1,1,1, the second 1,1,2 and so on.

In collecting the various layers of each block, care was taken to prevent any seed from sifting down from one layer to the one beneath it.

A. Purpose

These studies were planned and carried on in an effort to ascertain, if possible, the actual existence and seed longevity of viable seeds in the duff and humus layers in the various soils of the white pine region of northern Idaho. As the work began, it became evident that the progress of the work would not be materially slowed up if an exact count were kept of all seeds found in the soil. Hence, in the investigation, all seeds, both viable and non-viable, were counted and tabulated but only the data on the non-viable seeds are recorded in the following report.

B. Methods

The original plan of procedure as begun and carried out during the early part of the studies, consisted in locating definitely sampling sites representing, in so far as possible, the different age classes present in the areas. In these several areas a strip was selected, [illegible] inches in length and [illegible] inches wide. This strip was marked off into squares [illegible] inches on a side. Thus each strip yielded 10 squares arranged in linear formation.

With a wide-bladed knife each square was carefully cut around, the knife being pressed down below the level of mineral soil. With the same knife, the top layer, designated litter, was carefully peeled off the first square, placed in a paper sack and carefully labeled. The litter layer, represented a loose assemblage of twigs, needles and other debris.

Next, the second layer, the duff, was peeled off in the same manner and treated likewise. This duff layer is the layer commonly known as humus. The humus layer was next peeled off, care being taken in this case to secure the collection down to the layer of mineral soil. In practically all cases the layers from a single square were 3 in number, although there were a few cases in which the humus layer was divided into two samples. These samples were designated as 1, 2 and 3, respectively. The second block or square was collected in the same manner and so on for the ten squares of the strip. In labeling the various samples the strip number was indicated first; next came the block number and lastly, the sample. Thus, the first sample collected was called 1,1,1, the second 1,1,2 and so on.

In collecting the various layers of each block, care was taken to prevent any seed from sifting down from one layer to the one beneath it.

After the ten blocks had been collected, a description of the site was taken, including such information as the age class, dominant species, ground cover, slope, nearest Ribes bushes, etc. Other strips were selected and collected in a similar manner; the object being to select these strips from regions presenting as wide a variety of conditions as possible.

A total of thirteen such strips were collected and the resulting samples sifted and examined for seeds as follows:

The duff samples were brought to the Soil Physics Laboratory at the University of Idaho where the remainder of the work was carried on.

Each sample was sifted through three sieves of varying sized mesh. The sample was first put through a coarse grain sieve with apertures of 12/64 in. This separated out the larger objects such as stones, twigs, and other of the larger portions of litter. The material which did not go through the sieve was carefully examined for any seeds that may have adhered to masses of needles or other debris before being discarded. The material which had passed through the sieve was next put through another sieve with 1/12" apertures. In this case also, that material which did not pass through, was carefully examined for seeds before being thrown away. Next, a fine 30-mesh sieve was used which retained all of the material except the very fine particles. However, to prevent the possible loss of many of the very small seeds, the material which had passed through the 30-mesh sieve was now put through an ordinary 40-mesh kitchen strainer. That material which was retained in the strainer was added to the material retained by the 30-mesh sieve. It was found, however, that this amount was usually very small.

The sample was now put in the 40-mesh strainer and held under a slow stream of water until practically all of the soil particles were washed through the sieve. This reduced the samples to a minimum amount of soil. The sample was then spread out on a piece of paper, labeled and set aside until it was thoroughly dry. After drying, the sample was examined with the aid of a reading glass, the method of procedure being to take only a small portion of the sample and spread it out on a sheet of white paper. All seeds recovered from the sample were placed in a small coin envelope and labeled according to the original soil sample. The remaining soil was then placed in another coin envelope and labeled the same as the original sample.

Upon the completion of the recovery of seeds from the 13 strips the number of probable Ribes seeds appeared so low that a different method of collection seemed desirable. It was evident that although each strip represented a total of 10 blocks, or 30 samples, the general conditions for each of these 10 blocks was practically the same.

After the duff sample had been collected, a description of the site was taken, including such information as the age class, dominant species, ground cover, slope, nearest slash burns, etc. Other strips were selected and collected in a similar manner; the object being to select those strips from regions presenting as wide a variety of conditions as possible.

A total of thirteen such strips were collected and the resulting samples sifted and examined for seeds as follows:

The duff samples were brought to the Soil Physics Laboratory at the University of Idaho where the remainder of the work was carried on.

Each sample was sifted through three sieves of varying sized mesh. The sample was first put through a coarse grain sieve with apertures of 14/64 in. This separated out the larger objects such as stones, twigs, and other of the larger portions of litter. The material which did not go through the sieve was carefully examined for any seeds that may have adhered to masses of needles or other debris before being discarded. The material which had passed through the sieve was next put through another sieve with 1/12" apertures. In this case also, that material which did not pass through, was carefully examined for seeds before being thrown away. Next, a fine 20-mesh sieve was used which retained all of the material except the very fine particles. However, to prevent the possible loss of many of the very small seeds, the material which had passed through the 20-mesh sieve was now put through an ordinary 40-mesh kitchen strainer. That material which was retained in the strainer was added to the material retained by the 20-mesh sieve. It was found, however, that this amount was usually very small.

The sample was now put in the 40-mesh strainer and held under a slow stream of water until practically all of the soil particles were washed through the sieve. This reduced the samples to a minimum amount of soil. The sample was then spread out on a piece of paper, labeled and set aside until it was thoroughly dry. After drying, the sample was examined with the aid of a reading glass, the method of procedure being to take only a small portion of the sample and spread it out on a sheet of white paper. All seeds recovered from the sample were placed in a small coin envelope and labeled according to the original soil sample. The remaining soil was then placed in another coin envelope and labeled the same as the original sample.

Upon the completion of the recovery of seeds from the 13 strips the number of possible seeds appeared so low that a different method of collection seemed desirable. It was evident that although each strip represented a total of 10 blocks, or 30 samples, the general conditions for each of these 10 blocks was practically the same.

Hence, although approximately 120 blocks were examined, totaling 360 samples, there were in reality only 16 different sets of conditions represented. Therefore, during the remainder of the work, the samples were collected in a manner that would make them representative of a greater number of site conditions.

Various age classes were selected as before but instead of the blocks being grouped in strips in these sites, they were selected individually all over the site. In this manner each block represented a different situation from any of the others. 19 sites were represented and several blocks, ranging from 3 to 10 in number, were collected from each site. The samples were numbered similarly to those from the strips.

The coniferous seeds were identified and tabulated according to species but all of the others were referred to the seed laboratory at Washington for positive identification. Since the final identifications on these have not yet been received, no attempt has been made to segregate the ribes seeds from the other non-coniferous forms.

C. Results

The results obtained from these counts are tabulated in the following tables:

Table No. 2 shows the number of non-coniferous seeds recovered from the three layers of the organic mantle in the various age classes.

TABLE NO. 2

NUMBER OF NON-CONIFEROUS SEEDS IN EACH SAMPLE LAYER ACCORDING TO AGE CLASSES

Age Class	Number of Sites	Number of Samples	Number of Seeds in Litter Layer	Number of Seeds in Duff Layer	Number of Seeds in Humus Layer
			No. 1	No. 2	No. 3
20-40	10	77	241	791	1,805
40-60	4	25	18	74	252
60-100	4	27	9	34	405
100-150	7	55	18	112	357
150+	6	38	18	60	206
Totals	31	222	304	1,071	3,025

Table No. 3 shows the percentages of seeds as found in each layer according to age classes. The age classes and number of samples are the same as in Table No. 1.

Hence, although approximately 135 traces were examined, totaling 310 samples, there were in reality only 11 different sets of conditions represented. Therefore, during the remainder of the study, the samples were collected in a manner that would make them representative of a greater number of site conditions.

Various age classes were selected as before but instead of the blocks being grouped in strips in three plots, they were selected individually all over the site. In this manner each block represented a different situation from any of the others. 41 sites were represented and several blocks, ranging from 3 to 15 in number, were collected from each site. The samples were numbered similarly to those from the strips.

The coniferous seeds were identified and tabulated according to species but all of the others were referred to the seed laboratory at Washington for positive identification. Since the final identifications on these have not yet been received, no attempt has been made to segregate the alder seeds from the other non-coniferous types.

C. Results

The results obtained from these counts are tabulated in the following tables:

Table No. 2 shows the number of non-coniferous seeds recovered from the three layers of the organic mantle in the various age classes.

TABLE NO. 2

NUMBER OF NON-CONIFEROUS SEEDS IN EACH SAMPLE LAYER ACCORDING TO AGE CLASSES

Age Classes	Number of Sites	Number of Samples	Number of seeds in litter layer	Number of seeds in duff layer	Number of seeds in humus layer
			No. 1	No. 2	No. 3
20-40	11	77	281	703	1,508
40-60	4	35	11	71	223
60-100	4	27	5	54	403
100-150	7	52	[illegible]	11	359
150+	6	35	[illegible]	[illegible]	[illegible]
Totals	32	226	[illegible]	1,071	[illegible]

Table No. 3 shows the percentages of seeds as found in each layer according to age classes. The age classes and number of samples are the same as in Table No. 2.

TABLE NO. 3

PERCENTAGES OF SEEDS IN EACH LAYER ACCORDING TO AGE CLASSES

Age Class	Per Cent of Seeds in Litter Layer No.1	Per Cent of Seeds in Duff Layer No.2	Per Cent of Seeds in Humus Layer No.3
20-40	8.6	28	63
40-60	5.0	21	73
80-100	2.0	7	90
100-150	3.0	23	73
150+	6.0	21	72
Average for all	5.0	20 ~~19~~	74+

From the above results it is evident that there exists a marked difference in the number of seeds found in the various layers of the organic mantle.

Although as has been stated above, the exact number of Ribes seeds recovered has not yet been determined, it seems reasonable to suppose that they will follow the same distribution curve as the non-coniferous seeds taken as a whole. From observations made of the seeds it might be stated that nearly all the seeds recovered which resembled Ribes seeds were present in the duff or humus layer.

Therefore, judging from the results of Table No. 2, it is not unreasonable to predict that from 60 to 80 per cent of the Ribes seeds stored in the organic mantle are in the humus layer. These results, on superficial examination, apparently substantiate results and conclusions arrived at for the duff mantle studies, namely, that in any timber stand, regardless of age, the Ribes seeds are present wholly in the lower layer of the duff mantle and that this layer represents the first thirty years of duff and humus accumulation. Further, that such Ribes seeds as are present in this lower layer represent the accumulation only of those seeds that were produced during the first thirty years of the life of the stand, since Ribes do not exist in stands older than that.

However, the possibility must not be overlooked that Ribes seeds transported to and disseminated in a stand of timber trees, of any age and at any time, might likewise find their way to the base of the humus in a comparatively short period of time. It seems inconceivable to think that a seed the size of the Ribes seed might not, by the action of water and other agencies, settle down through the organic mantle and finally come to rest at the base of such layer. Comparing the position of the non-coniferous seeds in stands of various ages it is seen

that the numbers do not vary greatly. For example, in a forty-year-old stand 60 per cent of the seeds are found in the humus layer while in a stand of 150 years or more 72 per cent are located there. The remaining 28 per cent in the older stand are divided unequally between the duff and litter layers and would seem to represent those seeds which are in a constant state of settling down through such layers.

However, since these numbers do not represent Ribes seeds exclusively and since the samples as collected during the current season were not taken wholly from sites which could be designated as undoubtedly "Ribes free", it remains useless to draw positive conclusions. It is to be recommended, however, that such studies be continued for another season in the hope that the exact location of Ribes seeds can be determined with certainty. Such studies would not only settle this uncertain point but would also answer the question as to whether there is a continued and constant dissemination of Ribes seeds in the old as well as the very young stands of white pine.

RIBES SEED GERMINATION STUDIES

A. Purpose

The results thus far obtained from the several field studies have made evident the necessity of conducting carefully controlled laboratory studies on the various factors which control Ribes seed germination and growth. Among these factors are temperature, moisture, age of seed, degree of acidity or alkalinity of soil, and the variation in the reaction of the several species of Ribes to such factors. In addition, it is essential to follow up the germination and note the conditions which control the survival of such germinated seedlings.

With proper correlation of such laboratory and field results a more accurate picture can be drawn of the factor or complex of factors which control the germination and growth of Ribes in nature.

B. Methods

The experiment was started March 13, 1930 and discontinued September 30, 1930. Six constant temperatures and four alternating temperature combinations were used, namely, 5°C, 10°C, 15°C, 20°C, 25°C and 30°C were constant while 30°C day and 5°C night, 25°C day, 5°C night, 25°C day 10°C night, and 20°C day 5°C night were the alternating combinations. Ten sets of seeds were used: R. viscosissimum for the years 1925, 1926, 1927, 1928 and 1929; R. lacustre for the years 1927 and 1928, R. inerme for the year 1927, R. petiolare for the year 1927, and R. roezli for the year 1927. Seeds produced in 1927 were used as standard, because that year's seeds were available for each species.

that the numbers do not vary greatly. For example, in a forty-year-old stand 60 per cent of the seeds are found in the humus layer while in a stand of 100 years or more 72 per cent are located there. The remaining 28 per cent in the older stand are divided unequally between the duff and litter layers and would seem to represent those seeds which are in a constant state of settling down through each layer.

However, since these samples do not represent Ribes seeds exclusively and since the samples as collected during the current season were not taken wholly from sites which would be designated as essentially "Ribes free", it remains useless to draw positive conclusions. It is to be recommended, however, that such studies be continued for another season in the hope that the exact location of Ribes seeds can be determined with certainty. Such studies would not only settle this uncertain point but would also answer the question as to whether there is a continued and abundant dissemination of Ribes seeds in the old as well as in the very young stands of white pine.

RIBES SEED GERMINATION STUDIES

A. Purpose

The results thus far obtained from the several Ribes studies have made evident the necessity of conducting carefully controlled laboratory studies on the various factors which control Ribes seed germination and growth. Among these factors are temperature, moisture, age of seed, degree of acidity or alkalinity of soil, and the variation in the reaction of the several species of Ribes to such factors. In addition, it is essential to follow up the germination and note the conditions which control the survival of such germinated seedlings.

With proper correlation of such laboratory and field results a more accurate picture can be drawn of the factor or complex of factors which control the germination and growth of Ribes in nature.

B. Methods

The experiment was started March 13, 1930 and discontinued September 30, 1930. Six constant temperatures and four alternating temperature combinations were used, namely, 5°C, 10°C, 15°C, 20°C, 25°C and 30°C were constant while 20°C day and 5°C night, 25°C day, 5°C night, 25°C day 10°C night, and 30°C day 5°C night were the alternating combinations. Two sets of seeds were used: R. viscosissimum for the years 1925, 1926, 1927, 1928 and 1929; R. lacustre for the years 1927 and 1928, R. inerme for the year 1927, R. petiolare for the year 1927, and R. roezli for the year 1927. Seeds produced in 1930 were used as standard, because that year's seeds were available for each species.

Peat was used as the germination medium, and duplicate sets of seeds for each temperature were run, one set in natural peat which ran a pH of 3.7 and the other in peat neutralized by adding 5.79 grams of $CaCO_3$ per 100 grams of air-dry peat which ran a pH of 7.18. The peat used for this study was imported from Germany. Four grams of peat, air-dry basis, were placed in each dish, and sterilized in an autoclave at 10 pounds pressure for 45 minutes to kill any foreign seeds and any mold spores that might be present.

Sterilized water was used throughout the experiment, and the peat was kept at its saturation point. The seeds were soaked for 30 minutes in a 0.5 per cent solution of Uspulun to sterilize them, and then 50 per dish were planted. Mold, which developed in the dishes after planting, was kept down by a treatment of the Uspulun solution. All planting of seeds, watering of dishes, transferring of seedlings, etc. was done in the transfer chamber under as sanitary conditions as possible.

TABLE NO. 4

GERMINATION OF RIBES SEEDS UNDER ALTERNATING TEMPERATURES

Germination Factors		Number of Seeds Germinated by Species										
Temperature of Ovens	pH of medium	R. vis. 1925	R. vis. 1926	R. vis. 1927	R. vis. 1928	R. vis. 1929	R. lac. 1927	R. lac. 1928	R. pet. 1927	R. iner. 1927	R. roez. 1927	Total
30°C by 5°C	Acid	1	-	-	1	-	-	-	-	1	-	3
	Neutral	2	-	3	5	2	-	1	-	5	-	18
	Total	3	-	3	6	2	-	1	-	6	-	21
35°C by 10°C	Acid	-	-	-	-	-	2	-	-	1	-	3
	Neutral	17	12	23	36	14	25	1	-	12	-	140
	Total	17	12	23	36	14	27	1	-	13	-	143
25°C by 5°C	Acid	2	-	-	4	-	-	-	-	2	-	8
	Neutral	28	26	7	33	29	34	1	-	10	1	169
	Total	30	26	7	37	29	34	1	-	12	1	177
20°C by 5°C	Acid	1	2	2	1	2	1	-	-	1	-	10
	Neutral	35	23	17	34	30	31	-	-	5	-	175
	Total	36	25	19	35	32	32	-	-	6	-	185
Totals	Acid	4	2	2	6	2	3	-	-	5	-	24
	Neutral	82	61	50	108	75	90	3	-	32	1	502
	Total	86	63	52	114	77	93	3	-	37	1	526

TABLE NO. 5

GERMINATION OF RIBES SEEDS UNDER CONSTANT TEMPERATURES

Germination Factors		Number of Seeds Germinated by Species										
Temperature of Ovens	pH of Medium	R. vis. 1925	R. vis. 1926	R. vis. 1927	R. vis. 1928	R. vis. 1929	R. lac. 1927	R. lac. 1928	R. pet. 1927	R. iner. 1927	R. roez. 1927	Total
30°C	Acid	-	-	-	-	-	-	-	-	-	-	-
	Neutral	-	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-	-	-
25°C	Acid	-	-	-	-	-	-	-	-	1	-	1
	Neutral	1	-	1	1	-	1	-	-	2	-	6
	Total	1	-	1	1	-	1	-	-	3	-	7
20°C	Acid	-	-	-	-	-	-	-	-	-	-	-
	Neutral	4	-	-	2	-	1	-	1	-	-	8
	Total	4	-	-	2	-	1	-	1	-	-	8
15°C	Acid	-	-	-	-	-	-	-	-	-	-	-
	Neutral	1	-	-	1	-	-	-	-	-	-	2
	Total	1	-	-	1	-	-	-	-	-	-	2
10°C	Acid	1	-	-	1	-	-	-	-	3	-	5
	Neutral	-	-	1	3	-	-	-	-	-	2	6
	Total	1	-	1	4	-	-	-	-	3	2	11
5°C	Acid	1	1	-	1	1	-	-	-	5	2	11
	Neutral	-	1	5	8	-	-	-	-	-	5	19
	Total	1	2	5	9	1	-	-	-	5	7	30
Totals	Acid	2	1	-	2	1	-	-	-	9	2	17
	Neutral	6	1	7	15	-	2	-	1	2	7	41
	Total	8	2	7	17	1	2	-	1	11	9	58

TABLE NO. 6

PERCENTAGE OF GERMINATION UNDER MOST FAVORABLE CONDITIONS*

Germination Factors		Per Cent of Germination by Species							
Temperature of Ovens	pH of Medium	R. vis. 1925	R. vis. 1926	R. vis. 1927	R. vis. 1928	R. vis. 1929	R. lac. 1927	R. iner. 1927	Average
20°-5° C	Neutral	70.0	46.0	34.0	68.0	60.0	62.0	10.0	50.0
25°-5° C	Neutral	56.0	52.0	14.0	66.0	58.0	68.0	20.0	47.71
25°-10° C	Neutral	34.0	24.0	46.0	72.0	28.0	50.0	24.0	39.71
Average	Neutral	53.33	40.67	31.33	68.67	48.67	60.0	18.0	45.81

*Using most favorable temperatures and species that showed the highest percentage of germination.

TABLE NO. 7

MONTHLY GERMINATION OF RIBES SEEDS ACCORDING TO MEDIUM AND TEMPERATURE

Month of Germination	pH of Medium	Temperature of Ovens											Per Cent Germination Based on Total Germ.
		5°	10°	15°	20°	25°	30°	20°-5°	25°-5°	25°-10°	30°-5°	Total	
March (13 to 31)	Acid	-	-	-	-	-	-	-	-	-	-	-	0.0
	Neutral	-	-	1	1	2	-	2	3	7	1	17	2.9
	Total	-	-	1	1	2	-	2	3	7	1	17	2.9
April	Acid	-	-	-	-	1	-	10	3	-	2	16	2.7
	Neutral	2	-	-	-	1	-	71	69	63	1	207	35.5
	Total	2	-	-	-	2	-	81	72	63	3	223	38.2
May	Acid	2	1	-	-	-	-	-	4	-	1	8	1.4
	Neutral	2	-	-	-	-	-	42	43	33	6	126	21.6
	Total	4	1	-	-	-	-	42	47	33	7	134	23.0
June	Acid	7	1	-	-	-	-	-	1	3	-	12	2.1
	Neutral	9	5	-	5	2	-	27	31	20	4	103	17.6
	Total	16	6	-	5	2	-	27	35	23	4	115	19.7
July	Acid	1	1	-	-	-	-	-	-	-	-	2	0.3
	Neutral	2	1	-	1	1	-	15	9	7	5	41	7.0
	Total	3	2	-	1	1	-	15	9	7	5	43	7.3
August	Acid	1	2	-	-	-	-	-	-	-	-	3	0.5
	Neutral	4	-	1	1	-	-	18	14	10	1	49	8.4
	Total	5	2	1	1	-	-	18	14	10	1	52	8.9
Totals	Acid	11	5	-	-	1	-	10	8	3	3	41	7.0
	Neutral	19	6	2	8	6	-	175	169	140	18	542	93.0
	Total	30	11	2	8	7	-	185	177	143	21	584	100.0

C. Results

Table No. 4 shows the results of alternating temperatures on the germination of the different sets of seeds. When the totals, by temperatures, are compared, the combination of 20°C and 5°C shows the best results; but by individual dishes the 25°C and 5°C combination has the highest percentage of germination in any one dish. The table indicates that the 30°C and 5°C combination is too high for successful germination. This table also compares the germination of five consecutive years of seeds for R. viscosissimum. The results indicate that there is no appreciable loss of viability due to the different ages of the seeds of this species.

Table No. 5 compares the results of the constant temperatures on the germination of the different sets of seeds. There were not enough seeds germinated to be even indicative; but this table, when compared with Table 1, shows that an alternating temperature combination is preferred to a constant temperature. It appears that the 5°C and 10°C chambers were the best of the constant temperatures; but this can be explained, at least partially so, by the fact that with the facilities at that time, these two ovens could not be held constant and would vary about 5°C on either side of their intended constant temperatures which, in reality, made them a more or less alternating combination.

Table No. 6 gives a summary of the results obtained when the most favorable combinations of factors were employed. Using the alternating temperatures 20°C and 5°C with neutral peat as a medium, seven sets of seeds showed an average of 50 per cent germination. R. viscosissimum seeds produced in 1928, germinated in neutral peat, showed an average of 68.67 per cent for the three sets of alternating temperatures. This is the highest average obtained for any seeds.

Table No. 7 gives the germination for each temperature condition by the month. For the alternating temperature ovens, the peak of germination was reached in April and gradually decreased until August. During that month, there was a very slight increase due to extremely hot weather for three days, which caused both the 20°C and 25°C to go up 15°C and 10°C, respectively, during the day. The peak of germination in the constant temperature ovens was reached in June, or the 4th month after planting.

TABLE NO. 8

MONTHLY GERMINATION OF RIBES SEEDS ACCORDING TO MEDIUM AND SPECIES

Month of Germination	pH of Medium	Species of Ribes Seeds: R.vis. 1925	R.vis. 1926	R.vis. 1927	R.vis. 1928	R.vis. 1929	R.lac. 1927	R.lac. 1928	R.pet. 1927	R.iner. 1927	R.roez. 1927	Total	Per Cent Germination Based on Total Germination
March	Acid	-	-	-	-	-	-	-	-	-	-	-	0.0
	Neutral	6	6	-	5	-	-	-	-	-	-	17	2.9
(12 to 31)	Total	6	6	-	5	-	-	-	-	-	-	17	2.9
April	Acid	1	2	2	4	2	1	-	-	4	-	16	2.7
	Neutral	32	20	20	63	28	24	1	-	19	-	207	35.5
	Total	33	22	22	67	30	25	1	-	23	-	223	38.2
May	Acid	3	-	-	3	-	-	-	-	2	-	8	1.4
	Neutral	21	13	12	22	26	28	1	-	3	-	126	21.6
	Total	24	13	12	25	26	28	1	-	5	-	134	23.0
June	Acid	2	1	-	1	1	2	-	-	4	1	12	2.1
	Neutral	20	13	15	13	10	22	-	1	5	4	103	17.6
	Total	22	14	15	14	11	24	-	1	9	5	115	19.7
July	Acid	-	-	-	-	-	-	-	-	1	1	2	0.3
	Neutral	4	6	5	10	5	7	-	-	2	2	41	7.0
	Total	4	6	5	10	5	7	-	-	3	3	43	7.3
August	Acid	-	-	-	-	-	-	-	-	3	-	3	0.5
	Neutral	5	4	5	10	6	12	-	-	5	2	49	8.4
	Total	5	4	5	10	6	12	-	-	8	2	52	8.9
Totals	Acid	6	3	2	8	3	3	-	-	14	2	41	7.0
	Neutral	88	62	57	123	75	93	2	1	34	8	543	93.0
	Total	94	65	59	131	78	96	2	1	48	10	584	100.0

Table No. 8 gives the germination of species by the month. Of the sets of seeds that showed an appreciable germination, all but one reached their peak, both in acid and neutral peat, in April, and gradually decreased with a slight exception for August until the experiment was discontinued.

The two outstanding facts brought out by these studies are: first, that alternating temperature combinations are much better for germination than constant temperature, since about 90 per cent of the seeds germinated were in the four alternating temperature combinations; and second, that neutral peat is a more favorable germination medium than acid peat since 98 per cent of the total germinated seeds were in the neutral medium.

One current year's seeds were used--M. viscosissimum for 1929. Observations showed that they started germinating later than the other sets of seeds indicating the probable need of a rest period, but no data was taken on this phase. Further studies are needed to determine this point.

No conclusive results have been obtained, as the study has not progressed far enough to give sufficient data. Some very good leads, however, have been uncovered which will be of aid in future studies.

THE INLAND EMPIRE RIBES ERADICATION PROGRAM

By
C. C. Strong,
Associate Forester

INTRODUCTION

White pine blister rust is now so generally distributed throughout the white pine areas of the Inland Empire that owners are faced with the necessity of instituting protective measures at a much earlier time than was formerly predicted. The Ribes eradication activities conducted over the period since such work began have been largely experimental and aimed at developing methods whereby adequate protection to western white pine from blister rust might be secured at a minimum cost. The rapid advance of white pine blister rust has caused the experimental work to be speeded up to the maximum and actual control work to have been started on the basis of the most effective methods.

The interest and good faith of some of the larger operating companies in north Idaho was demonstrated in 1929 when the Clearwater and Potlatch Timber Protective Associations voted, respectively, to take advantage of the cooperative financial arrangements which the Federal Government was ready to extend. Much white pine acreage, especially that not bearing merchantable material and which would be a constant financial burden to the owner due to protection, taxes, etc., even though bearing excellent stands of white pine reproduction and pole timber, would very probably not be protected. In most such cases owners were financially unable to protect against blister rust. Such lands, where intermingled with larger holdings of interested companies, were a decided handicap and in many cases were covered without the owner's assistance. However, this procedure would not have been practicable in regions where the bulk of lands are held by these small owners, most of whom are virtually bankrupt.

The condition which was described just above is a serious one so far as control of white pine blister rust is concerned. Hundreds of thousands of acres of what was once the best white pine land in the Inland Empire are represented. Heavy burning and reburning following logging has reduced some of this land to a barren state except for what grass is available for grazing purposes. The bulk of it, however, now supports white pine reproduction ranging up to 30 or 40 years of age, much of which is as good as any in the Inland Empire. Surely a way must be found to protect this timber. Even though it is in private hands there is no argument in favor of a national policy which permits reforesting of poorer sites on public lands and does not provide for protecting such excellent established growth on the best sites little of which can ever be classed as agricultural land.

PROJECT ACTIVITIES

A. Experimental Work

The rapid advance of blister rust naturally limits the period during which its effective control must be accomplished. There are many problems which come up regarding crew methods, spraying machinery, the development of new ways of killing Ribes, etc., which must be solved. For this purpose a special methods project was set up some years back. As time goes on more and more problems present themselves for solution. These are immediately turned over to the methods project and a special experiment conducted to give the desired information if it cannot be obtained from existing experiments.

B. Cooperative Ribes Eradication

One of the important purposes in all the experimental Ribes eradication activities in the past was to train men to supervise such work in the future. Hence it was that when the two timber protective associations voted funds for Ribes eradication the Office of Blister Rust Control was ready to administer the work.

In 1930, when the United States Forest Service obtained an appropriation to initiate such work on national forests the Office of Blister Rust Control was ready with a trained personnel who administered the work. The National Park Service secured funds to start blister rust control on certain areas bearing valuable white pine timber in 1930 and naturally turned to this organization for trained men to supervise the job.

It is a source of much satisfaction to the Western Office of Blister Rust Control that cooperators have expressed entire approval of the business-like manner in which the work has been done.

REPORTS

In accordance with the plan followed in the 1929 annual report of Ribes eradication activities in the Inland Empire the individuals who directly supervised the field activities in 1930 have carefully prepared reports dealing with the work for which each was responsible. The reports follow according to the order in which they are here listed:

[illegible]

4. Experimental Work

The rapid advance of blister rust naturally limits the period during which its effective control must be accomplished. There are many problems which come up regarding [illegible] methods, including machinery, the development of new ways of killing Ribes, etc., which must be solved. For this purpose a special methods project was set up some years back. As time goes on more and more problems present themselves for solution. These are immediately turned over to the methods project and a special experiment conducted to give the desired information if it cannot be obtained from existing experiments.

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One of the important purposes in all the cooperative Ribes eradication activities in the past was to train men to supervise such work in the future. Hence it was that when the [illegible] protective associations voted funds for Ribes eradication the Office of Blister Rust Control was ready to administer the work.

In 193[illegible], when the United States Forest Service obtained an appropriation to initiate such work on national forests, the Office of Blister Rust Control was ready with a trained personnel who administered the work. The National Park Service received funds to start blister rust control on certain areas bearing valuable white pine stands in 193[illegible], and naturally turned to this organization for trained men to supervise the job.

It is a source of much satisfaction to the Eastern Office of Blister Rust Control that cooperators have expressed entire approval of the business-like manner in which the work has been done.

REPORTS

In accordance with the plan followed in the past annual report of Ribes eradication activities in the [illegible], the [illegible] men who directly supervised the field activities in 1937 have carefully prepared reports dealing with the work for which each was responsible. The reports follow according to the order in which they are here listed:

Chemical Eradication Methods.

Chemical Eradication Methods, Supplemental Report on Experimental and Field Equipment.

Ribes Eradication, National Forest.

Preliminary Ribes Eradication Survey of the Palouse Division of the St. Joe National Forest.

Preliminary Ribes Eradication Survey, Priest River Experiment Station.

Cooperative Local Control Work, Clearwater Timber Protective Association.

Cooperative Local Control Work, Potlatch Timber Protective Association.

PLANS FOR FUTURE WORK

Ribes eradication, by suitable methods, has proven adequate to control blister rust under eastern conditions when carefully done. However, no one knows, nor is there any source from which such information might be obtained, whether or not Ribes eradication by methods adapted to conditions encountered will afford adequate protection to white pine in the Inland Empire. To make this determination it is planned to set up demonstration control areas in regions where the rust now is present. It is thus hoped to show quickly how thorough a job of Ribes eradication must be in order to constitute adequate control in the region.

Recent developments along lines of chemical investigations point to the necessity of devising new types of equipment for applying toxic agents to Ribes. This, of course, calls for parallel experiments designed to perfect methods of using this new equipment.

There are various other lines along which it is planned to conduct experiments. These will be covered in the methods report.

CHEMICAL ERADICATION METHODS

By

H. E. Swanson,

Agent

INTRODUCTION

Previous to the 1929 field season, several more or less extensive comparisons and tests had been made between power and knapsack spraying methods. These comparisons consistently showed knapsack spraying to be the more satisfactory. However, confronted with the problem of stream type eradication on some 3,000,000 acres of white pine type, it was deemed advisable to continue experimenting and developing power methods until its possibilities were regarded as being exhausted. During the 1929 season, a practical, smooth running, and simplified method of power spraying was developed. It was conceded that on some of the area on which this work was done, power spraying was the more practical method. The area was a wide stream type with heavy brush and Ribes conditions prevailing with reasonable uniformity over a distance of eight miles. On account of the successful performance on this area, a power unit was placed in the field during the 1930 season.

In past experiments, all comparisons were made by spraying the same area by both methods. This means of comparison was discarded in 1930 because of certain drawbacks, principally the great cost involved in covering an area twice and also because of the difficulty of getting a fair test on the method used on the second time over. During the past season, a different approach was made to the problem. A man was assigned to make some specific time studies of the component operations making up each spraying method. From these data, it is possible to determine the productive time (actual spraying time) of a laborer engaged in each method of spraying.

PURPOSE

The principal purpose of this project is to develop and improve methods of Ribes eradication in order to reduce costs and increase the efficiency of the work. In working toward this end, certain practical methods have been developed. Careful observation and analysis of the work and results in chemical eradication have shown that the individual section method of spraying by which a man works alone is the most satisfactory method. With the general plan of working developed, it becomes necessary to study the component elements of the method in order to gain a further understanding of the problem and possible leads for improvement of the method.

The more specific aims of the project are:

1. To study and analyze all the phases of chemical eradication methods.

2. To test all possible methods of working.

3. To develop new equipment for use in applying different chemicals and to improve upon the equipment now in use. To test all new equipment in the field. This phase of the project is handled in a supplementary report.

LOCATION AND DESCRIPTION OF AREA

The work was conducted on the Musselshell District of the Clearwater National Forest in conjunction with the control work financed by the Forest Service. The areas having the heaviest concentrations of Ribes were selected for the project on account of the work to be done with the power equipment. (See report on Ribes Eradication on National Forests for a fuller description of the area.)

ORGANIZATION OF WORK

During the month of June approximately 90 men divided among four camps were engaged in methods studies. After securing some essential data on knapsack spraying three of these units were transferred to the Forest Service for blister rust control work on July 1. For the balance of the season a 25-man camp carried on the methods work. The spraying equipment consisted of a 15-man power unit, a 5-man power unit, 15 knapsack units, and special equipment to be tested in the field.

Maintenance of the unit is described under report on Ribes Eradication on National Forests.

TABLE NO. 1

STATEMENT AND ANALYSIS OF COSTS

Item	Cost
Salaries	
Supervision	$1,244.07
Temporary men	6,407.21
Special	297.00
Subsistence	
Cooks' Salaries	825.09
Cost of food	2,103.49
Transportation of food	398.72
General Equipment	
Cost	158.20
Transportation	361.21
Spraying Equipment	622.43
Miscellaneous	
Supplies	106.75
Expenses	34.64
Repairs	140.00
Twine	49.20
Chemical	
Cost	886.10
Transportation	272.46
Transportation of men	346.84
Total	$14,255.41

TABLE NO. 2

COST OF MEALS

Item	Costs
Cooks' salaries	$828.09
Cost of food	2,103.49
Transportation of food	398.62
Total	$3,330.20

Number of meals.... 9,171

Cost per meal..... $.363

WORK PERFORMED AND RESULTS ACCOMPLISHED

TABLE NO. 3

CHEMICAL ERADICATION ON THE CLEARWATER NATIONAL FOREST BY METHODS UNIT - 1930

Method	Man-Days	Gallons Chemical	Acres Sprayed	Total Cost	Data Per Acre		
					Man-Days	Gallons Chemical	Cost
Power	460	12,186	316	$4,559.23	1.46	38.6	$14.43
Knapsack	148	2,832	117	1,652.89	1.26	24.2	14.13
Total	608	15,018	433	$6,212.12	1.40	34.7	$14.35

TABLE NO. 4

HAND ERADICATION ON THE CLEARWATER NATIONAL FOREST BY METHODS UNIT, 1930

Type	Man-Days	Acres	Total Cost	Number Ribes Pulled					Data Per Acre		
				R. lac.	R. pet.	R. vis.	R. iner.	Total	Man-Days	Ribes	Cost
Str.	1,082	1,357	$7,746.29	208,718	23,637	3,513	77,353	313,221	.80	231	$5.71

TABLE NO. 5

ERADICATION SUMMARY ON CLEARWATER NATIONAL FOREST BY METHODS UNIT, 1930*

Man-Days	Pounds Chemical	Acres Worked	Total Cost	Acres Partially Protected	Per Cent of Area Stream Type	Cost Per Acre to Eradicate of Ribes	Cost per Acre for Partial Protection
1,090	12,700	1,357	$13,958.41	16,200	8.38	$10.29	$.862

*See Report on Ribes Eradication on National Forests for a complete summary of work by all eradication units on the Clearwater National Forest.

DISCUSSION AND ANALYSIS OF RESULTS

Along with the performance of any special experiments or studies, actual protection is also secured, as shown in tables No. 3, 4 and 5. A comparison of the cost of knapsack spraying as against power spraying in Table No. 3 would indicate an advantage in favor of power on a medium concentration of Ribes, because the cost per acre for knapsack spraying on a somewhat lighter concentration of Ribes is practically the same as the cost for power spraying. This cannot be taken as a basis of comparison because the power work was performed on the main drainages which were readily accessible from the camp, while the knapsack spraying was done on the scattered areas on the side drainages which were in most cases at considerable distances from the camp. Consequently the time involved getting into these areas with men, equipment and chemical has a great effect upon the cost. These areas were too scattered and too small to warrant the establishment of side camps to work them out. Also the number of working days on knapsack spraying was not sufficient to absorb a proper proportion of the equipment costs chargeable against the season's operation.

A direct and fair comparison of knapsack and power spraying was made in a special study in which such factors as mentioned above were eliminated.

SPECIAL EXPERIMENTS AND STUDIES

A. Power Spraying

1. Equipment. Further tests were made with the motors.

The Ross blister-rust-control units No. 11 and 12, which consist of a 1-cylinder, 2-cycle Cushman motor and a Ross 2-stage rotary pump, were used extensively for the first time since the old air-cooling systems had been discarded and new water jacket cylinders cast and installed on the units. These units were the lightest used and were the most satisfactory. They were the most dependable and gave the most uniform service. The small amount of gas required to operate them is also an advantage. They had sufficient power to handle the maximum requirements of a full crew.

The performance of the Ross No. 10 Type L-1, a 2-cylinder, 2-cycle motor with a small rotary pump and the performance of the Pacific Marine No. 1708 Type W Fire Fighter, a 4-cylinder, 2-cycle motor with a semi-centrifugal pump were satisfactory. However, these units have more power than is necessary for the type of spraying which is done. Working under a reduced load, their performance is not as steady and uniform as in the case of the smaller units. Their consumption of gasoline is considerably greater than that of the Ross units No. 11 and 12. The larger units will

be used to greater advantage when a dilute solution is developed making it necessary to apply a great amount of solution on an area.

2. Methods

Size of power spraying unit.

The same equipment, set-up and method of spraying was used as in 1929. However, a smaller unit was given a trial. The larger 10-man spraying unit used in 1929 is adaptable to extensive areas with heavy Ribes concentrations. This unit is too large to put on any area or drainage having less than 150 or 200 acres of stream type. A 5-man power spraying unit can be placed on these smaller areas without necessitating costly and frequent moves of the equipment. The 5-man outfit proved satisfactory. It has certain advantages over the 10-man unit, the principal one being that the men can be given more supervision. The fact that the unit is smaller and less equipment is required makes it more mobile. It can be easily carried over small areas where Ribes are absent.

The scope of the two units is this:

The 10-man unit is best adapted to drainages in which Ribes concentrations are uniformly heavy over an area of stream type of five miles or more in length and of 200 feet or more in width.

The 5-man unit is best adapted to drainages where Ribes conditions are not uniform but where there are areas of 50 to 200 acres with heavy Ribes conditions scattered along the drainage.

B. Time Analysis Study

The stop-watch method was used for securing the data. Each component part making up the complete spraying operation in both power and knapsack work was accurately timed. The study was made on 20 man-days of power spraying and and 18 man-days of knapsack spraying.

TABLE NO. 6

TIME ANALYSIS OF THE WORK OF A MAN ENGAGED IN POWER SPRAYING

Operation	Minutes	Per Cent
All work timed	8,442	100.0
Spraying	2,529	30.0
Searching	2,904	34.4
Laying string line	772	9.1
Handling lateral hose	593	7.0
Handling main-line hose	165	2.0
Moving to new section	719	8.5
Equipment	305	3.6
Personal	244	2.9
Waiting for power	64	0.8
Supervision	30	0.4
Checking	30	0.3
Hand pulling	14	0.2
Other	73	0.9

1. 52 gallons per acre.
2. 740 minutes per acre.
3. Definition of terms:

Spraying - Actual time nozzle is discharging spray.

Searching - Finding the Ribes.

Laying string line - Marking strip boundaries with string.

Handling lateral hose line - moving, untangling, coiling, or any handling of the ¼" hose on a block.

Handling main line - Any handling of the ¾" hose. This is not a regular duty of the sprayer.

Moving to new section - After the completion of a block, moving to another. A sprayer may work from one to three blocks in a day. A move may be from 500 feet to 1,200 feet.

Equipment - Any repairing or adjusting of equipment which detracts from actual eradication work.

Personal - Personal factors, such as rests.

Waiting for power - Delay caused by break-down or failure of the motor.

Supervision - Any instructions from foreman which caused delay or interruption in work.

Checking - Looking over area to determine whether any strips or bushes had been missed.

Hand pulling - Pulling bushes by hand where this could be done more advantageously than spraying them.

TABLE NO. 7

TIME ANALYSIS OF THE WORK OF A MAN ENGAGED IN KNAPSACK SPRAYING

Operation	Minutes	Per Cent
All work timed	6,888	100.0
Spraying	2,508	36.3
Searching	2,496	36.3
Filling tanks	852	12.4
Mixing chemical	140	2.0
Equipment	123	1.8
Packing chemical	192	2.8
Personal	286	4.2
Supervision	47	0.7
Checking	13	0.2
Hand pulling	171	2.5
Other	60	0.8

1. 84 gallons per acre

2. 690 minutes per acre.

3. Definition of terms:

Spraying - Same as for power.

Searching - Same as for power.

Filling tanks - All activity involved from the time a spray tank is emptied until the worker has returned to his strip with a full tank of spray and resumed spraying operations.

Mixing chemical - Preparing liquid solution for spray. This is not a regular duty of the sprayer.

Equipment - Same as for power.

Packing chemical - Carrying chemical from a cache to a filling station. Any packing of chemical done while walking to work which did not detract from the time actually spent in eradication is not included in this classification.

Personal - Same as power.

Supervision - Same as power.

Checking - Same as power.

Hand pulling - Same as power.

Note: There is no item "packing chemical" under power spraying on account of the fact that the few stations required in this method makes it possible to unload the drums of chemical directly from the pack mules to the stations.

TABLE NO. 8

COMPARISON OF THE TIME ANALYSES OF POWER AND KNAPSACK SPRAYING ON A PER ACRE BASIS

Operation	Power		Knapsack	
	Minutes	Per Cent	Minutes	Per Cent
Net time	669	100.00	607	100.00
Spraying	208	31.13	23[illegible]	38.3[illegible]
Searching	239	35.74	221	36.24
Laying string line	64	9.50	-	-
Handling lateral hose	49	7.30	-	-
Handling main-line hose	14	2.09	-	-
Filling tanks	-	-	80	13.05
Mixing chemical	-	-	13	2.14
Packing chemical	-	-	18	2.94
Equipment	33	4.91	12	1.98
Moving to new section	59	8.85	-	-
Other	4	0.54	30	5.32

1. 52 gallons per acre on power area.
   54 gallons per acre on knapsack area.

2. All activities not a part of the spraying work and not dependent upon the method of spraying have been eliminated from this table.

TABLE NO. 9

COMPARISON OF THE PRODUCTIVE EFFICIENCY OF POWER AND KNAPSACK SPRAYING ON AREAS OF VARYING RIBES DENSITY
(See Chart No. 1.)

Gallons	Power	Knapsack
Per Acre	Minutes Per Acre	Minutes Per Acre
11	330	200
15	418	240
35	-	420
52	669	[illegible]
54	-	607
78	730	780
200	930*	1,377*

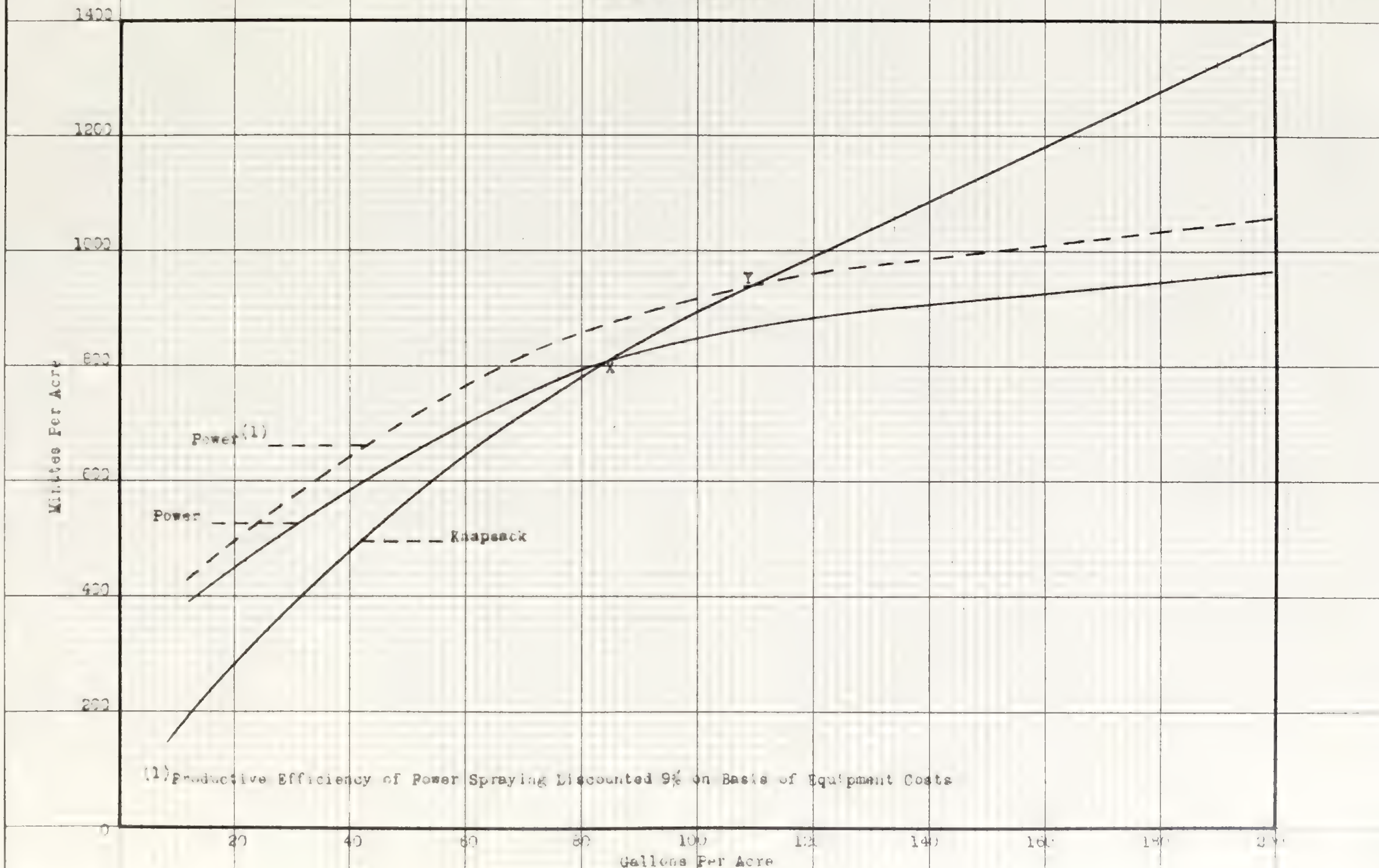
Source of data - Experiments conducted at Bovill, Idaho, 1928; Morro Bay, California, 1929; Clearwater National Forest, 1929-1930.

*These figures were computed using the data secured in the time analysis study as a basis.

CHART NO. 1

COMPARISON OF THE PRODUCTIVE EFFICIENCY OF POWER AND KNAPSACK SPRAYING ON AREAS OF VARYING RIBES DENSITY

(Data in Table No. 9)



Annual Report 1933
H. E. Swanson

DISCUSSION AND ANALYSIS OF EXPERIMENTS

The results of the time analysis study show that 67 per cent of the time of a man engaged in power spraying on an area with a Ribes density of approximately 20 per cent is spent in searching for and spraying Ribes. The other 33 per cent of the worker's time is used in handling equipment or marking the area with string lines for satisfactory working. This 33 per cent is made up of six different operations or activities, none of which alone involves a great amount of time.

In power spraying, the entire set-up of hose lines and equipment must be lined out on an area whether twenty gallons or two hundred gallons per acre are required to spray the Ribes. Consequently the time involved in laying out the equipment is constant, regardless of the Ribes concentration. The heavier the Ribes concentration, the higher becomes the actual spraying or productive time and the proportion of time spent on supplementary operations becomes less. Herein lies the value of power spraying methods, the application of a large volume of spray on a small area.

In knapsack spraying, the same study shows that 77 per cent of the worker's time on an area with a Ribes density of approximately 20 per cent is spent in searching for and spraying Ribes. The other 23 per cent of the operator's time is spent on five different operations or activities, the largest of which is the filling time. In the case of knapsack spraying, the time involved in these supplementary activities is not constant on areas having varying Ribes concentrations. This time varies in proportion to the total time required to work an area.
In order to apply a larger number of gallons of spray to an area, it is necessary to pack and mix additional chemical and also to fill the spray tanks in direct proportion to the greater number of gallons required. Consequently, the productive time of knapsack spraying methods remains fairly constant as expressed in a percentage of the total time required to cover an area.

All experiments conducted to show the relative merits of power and knapsack spraying have shown knapsack methods to be the more satisfactory. In Chart No. 1, the results of these various experiments, including the data secured on the time analysis studies conducted in 1933, have been used in the construction of a curve to show the scope of the two methods. In this chart, the figure of 200 gallons per acre represents the amount of chemical necessary to spray an area with 100 per cent ground cover of Ribes. This measure was secured by a study in which an area was carefully selected for a 100 per cent ground cover of brush, which brush was for the most part Ribes, the other bushes on the area being quite comparable to Ribes as to size and leaf surface. Careful spraying of all this brush required 200 gallons.

In constructing the curves for power and knapsack spraying, actual data were available for areas requiring from 11 gallons to 79 gallons per acre. However, since it is known that 200 gallons per acre represents the number of gallons required on a 100 per cent Ribes concentration, it was possible to compute from the data secured in the time analysis study, the amount of time required to spray such a concentration.

Point X, representing 82 gallons per acre, determines the concentration of Ribes on which the actual time required by the operator to cover the ground is exactly the same in either knapsack or power spraying. On areas requiring less than 82 gallons per acre, a man equipped with a knapsack sprayer can cover the ground faster than a man engaged in power spraying. When more than 82 gallons per acre are required, the ground can be covered faster by power spraying.

In power spraying, the cost of equipment required for a crew of 10 sprayers is considerably more than that required for a like number of knapsack sprayers. On this basis, it costs 9 per cent more to maintain a man for each working day on power spraying than it does to maintain a man on knapsack spraying. The dotted line curve on the chart designated as "power[1]" takes this fact into consideration and discounts the speed of power spraying by 9 per cent. Therefore, point Y at 109 gallons per acre represents the point at which the scope of knapsack spraying ends and that of power spraying begins.

As there are very few areas on which more than 50 or 60 gallons per acre are required to spray the Ribes, knapsack spraying methods should be used on all practical operations.

In the construction of the curves on the productive efficiency of spraying methods, it was presumed that a single No. 111 fine nozzle is used as standard equipment. On the heavier concentrations, where 100 gallons or more are required per acre, it would be possible to use a double nozzle to great advantage which would reduce the time required to spray the bushes. If a double nozzle was used on the heavier concentrations, the upward trend of the curves would be less. However, the effect upon the two curves would be approximately proportional, as the advantage of the double nozzle would accrue to both power and knapsack spraying.

This analysis of the two methods of spraying will hold as long as the present type of chemical is used. On account of the approximate cost of 12 cents per gallon for the chemical, dependent somewhat upon the amount of transportation necessary to place the chemical on the job, it is necessary to be as conservative as possible in its use. When a cheaper chemical is developed which is effective on Ribes, permitting the use of a greater volume of spray applied in a more broadcast manner,

power spraying will have a definite advantage.

PLANS FOR FUTURE WORK

A. Chemical Eradication

At the present time, the chemicals which are adaptable to field use have been effective on R. petiolare only. Heavy concentrations of R. inerme and R. lacustre in stream type represent an almost insurmountable problem to hand pulling methods. In view of the development of chemicals requiring different methods of application which will be effective on all Ribes species, it is necessary to devise suitable equipment and crew methods for performing this work.

The experiments divide themselves into three divisions based upon the kind of chemical used. The ultimate purpose of these experiments is to determine the most effective and economical means of destroying all species of Ribes in stream type. This involves the testing of the various chemicals by different methods or combination of methods of application.

1. Use of Atlacide in 10 per cent solution. (This division also includes the use of a solution of sodium chlorate in various concentrations.)

a. Successive applications of this spray to the aerial portion of the Ribes by using present equipment and crew methods, to determine the number of applications required to kill R. inerme and R. lacustre.

b. Spraying the aerial portion of the bush and also the adjacent ground in order to reach the roots. Present equipment and crew methods will be used.

2. Soil application treatment.

a. A broadcast spraying operation using a large volume of a cheap salt or other solution by which the soil is sufficiently saturated that the roots of the Ribes bushes will take in the chemical. This method would be performed with power equipment.

b. A localized application of a concentrated solution to the soil surrounding the roots of the bushes. This operation may require either knapsack or power spraying equipment.

3. Stem injection.

a. This requires the injection of a paste substance into the stem of the Ribes. Special tools must be designed for making the injections. As the development of this chemical and any knowledge of the number and location of injections required on the Ribes bushes for

killing is in an elemental stage, the experiments conducted along this line will involve a careful and thorough study of these factors as well as the working out of a practical method of application.

4. Reworking areas after original spraying operation. In the absence of any information showing that any of the above chemicals will completely kill the Ribes (especially R. inerme) after the first application, studies are to be made on areas where R. inerme had been sprayed with a 10 per cent solution of Atlacide in 1930. In 1931, hand pulling, soil application, and a combination of hand pulling and soil application methods are to be used on this area in order to determine the most economical method of eradicating R. inerme.

5. Hand pulling. In order to secure comparative cost and efficiency data on these areas, a certain amount of hand pulling work is to be done both on the areas which are being worked for the first time and on the areas that are being reworked the second year.

B. Hand Eradication

1. Relation of costs to efficiency. The experiments will be designed to show the cost of work necessary to secure various degrees of efficiency measured in the number of feet of live stem left on the area.

2. Methods of working to reduce the amount of live stem left on an area. All data show that a 3-man or 4-man crew with no one checking directly behind the crew is the most satisfactory method. To insure efficient work and to reduce the amount of live stem left on an area to a protective standard, it is necessary to rework the area. In these experiments, selected men will be assigned to rework all the strips covered by the regular eradication crews on areas where Ribes were present. The variations in the method of reworking, which are to be given a trial, will consist in the number of men making up the crew which does the reworking. The number of men used will vary from one man to the number of men in the regular eradication crew which worked the strips originally.

Some data secured in previous experiments are already available which indicate the practicability of the method. The method of reworking by one man is far more efficient and more economical than the old method of a foreman checking directly behind the line.

3. Uphill-downhill as compared to uphill-contour work. No conclusive data have been secured showing the most satisfactory method of working slopes which are extensive enough to permit uphill and downhill work or uphill and contour work. The present method in general use is to work uphill to the ridge top and then work in the direction of the contour. However, evidence secured in a small experiment conducted in

pulling is in an elemental stage. The experiments conducted along this line will involve a careful and thorough study of these factors as well as the working out of a practical method of application.

4. Reworking areas after original spraying operation. In the absence of any information showing that one or two sprays will completely kill the Ribes (especially R. inerme) after the first application, studies are to be made on areas where R. inerme had been sprayed with a 10 per cent solution of [illegible] in 1930. In 1931, hand pulling, spot spraying, and a combination of hand pulling and spot application methods are to be used on this area in order to determine the most economical method of eradicating R. inerme.

5. Hand pulling. In order to secure comparative cost and efficiency data on these areas, a definite amount of hand pulling work is to be done both on the areas which are being sprayed for the first time and on the areas that are being sprayed the second year.

B. Hand eradication

1. Relation of costs to efficiency. The experiments will be designed to show the cost of work necessary to secure various degrees of efficiency measured in the number of feet of live stem left on the area.

2. Methods of reworking to reduce the amount of live stem left in an area. All data so far [illegible] directly behind the crew is the most satisfactory method. To secure efficient work and to reduce the amount of live stem left on an area to a protective standard, it is necessary to rework the area. In these experiments, selected men will be assigned to rework all the strips covered by the regular eradication crews on areas where Ribes were present. The variations in the method of reworking, while not to be given a trial, will consist in the number of men making up the crew which does the reworking. The number of men used will vary from one man to the number of men in the regular eradication crew which worked the strips originally.

Some data secured in previous experiments are already available which indicate the practicability of the method. The method of reworking by one man is far more efficient and more economical than the old method of a foreman reworking directly behind the line.

3. Uphill-downhill as compared to uphill-contour work. No conclusive data have been secured showing the most satisfactory method of working slopes which are steep enough to permit uphill and downhill work or uphill and contour work. The present method in general use is to work uphill on the ridge leg and then work in the direction of the contour. However, evidence secured in a small experiment conducted in

1928, shows a decided advantage in favor of downhill work as against contour work. Data on this point can be secured on large areas by working blocks of 500 to 1,000 acres by the two methods. This can be done in conjunction with the regular eradication work.

1918, shows a decided advantage in favor of downhill over as [illegible] earlier work. Data on both points are [illegible] as large areas by using blocks of 200 to 1,000 acres by the [illegible]. This was done in conjunction with the regular predicting work.

CHEMICAL ERADICATION METHODS

SUPPLEMENTAL REPORT
ON
EXPERIMENTAL AND FIELD EQUIPMENT, 1930

By
John F. Breakey
Agent

PURPOSE

The improvement of present equipment for the chemical eradication of Ribes, and the development of new apparatus, is the purpose of equipment study and experimentation.

WORK PERFORMED AND RESULTS ACCOMPLISHED

A. Improvement of Equipment Now in Use.

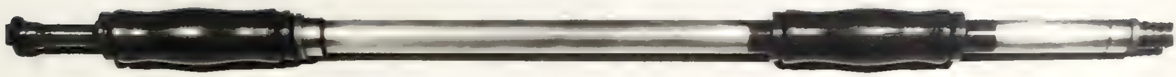
1. Brown pump. The Brown pump, a detailed description of which was given in the 1929 blister rust report, is a double-acting trombone cylindrical brass pump, capable of pumping 250 pounds maximum pressure and delivering 5 cubic inches of liquid for each 2 cycles of the plunger. This pump is designated as No. 1 Type A in the accompanying photograph. It is relied upon for all extensive chemical spraying in blister rust control operations in the Northwest. It became necessary to replace the plunger stop ring B-PIA-6 and the packing stop ring B-PIA-10 with heavier, more durable rings. The Brown Company has since agreed to make these changes. A complete set of repair parts as shown in the photograph was furnished to all field camps.

2. Trigger nozzles. The brass automatic trigger nozzle needle valves on power spraying units were replaced with a needle valve having a mild steel tip and a brass seat. The all-brass needle valves broke at a point where the handle was fastened to them.

3. Ball check valve releases. Pins for releasing the ball check valves attached to the ends of the laterals on the power spraying lines were devised. These are similar to the pins designed in 1929 with the exception that they are removable and interchangeable. A set screw was supplied on each automatic nozzle to adjust the flow of spray when engaged in the trigger nozzle.

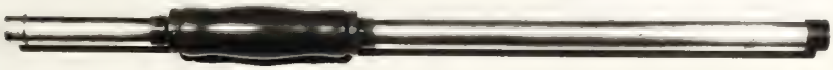
4. Hose for knapsack spray tanks. In 1929 a 1/2" light weight wrapped hose, 30 inches in length was used on spray tanks. Considerable

PUMP – NUMBER 1 – TYPE A



B – PIA

B – P A –



B – PIA – 2

B – PIA – 3

B – PIA – 4

B – PIA – 5

B – PIA – 6

B – PIA – 7

B – PIA – 8

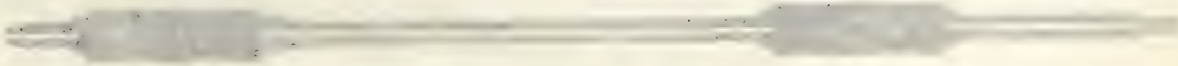
B – PIA – 9

B – PIA – 10

B – PIA

PUMP – FIELD EQUIPMENT –
OFFICE
U. S. DEPARTMENT
12 – 4 – 30
BY

Annual Report 1930
J. F. Breakey



difficulty was experienced by operators caused by the hose pinching as it swung through a 45-degree arc when the pump was in operation. A heavy pressure hose was supplied in 1930. The tank hose fittings were fastened to an elbow attached to the tanks. This heavy hose was unsatisfactory. It placed so much strain on the small hose fitting on the 27-gage sheet iron tank that a break in the tank usually occurred. This was caused in part by the elbow. At the close of the field season the elbows were removed and the heavy hose was discarded.

5. The pack frames were made more satisfactory for carrying tanks by the attachment of metal supports and by the use of eye bolts in place of screw eyes.

6. All field equipment was overhauled and put in first-class shape at the end of the field season.

B. The Development of New Equipment.

1. Duster. A knapsack type of machine was constructed to scatter chemical in the form of a dust. Hydraulic force secured by the operation of a plunger in a small tube in the hands of the carrier is applied to the two larger cylinders on the sides of the duster, causing the bellows to close and at the same time working a dust agitator and a force feed enclosed in the hopper of the machine. Springs return the bellows to its normal position. Wheels and ratchets operate the worm and screw mechanism which comprises the agitator and feed mechanism.

The dusting experiments conducted show that the dust in its present state (Atlacide) is not satisfactory. Large quantities are needed to do an effective job because of waste, and it is not possible to dust continually during the entire day on account of humidity changes.

The hygroscopic agent in the dust ceases to absorb enough moisture from the air during the heat of the day to cause the dust to stick to the Ribes.

2. Federal pump No. 3, Type A. This pump is a double-acting trombone variety cylindrical brass pump capable of pumping a maximum pressure of 450 pounds and with an average working pressure, under normal conditions, of 100 pounds and capable of delivering 4 cubic inches of liquid for each 2 cycles of the plunger. This small high pressure pump was made to shorten the actual time consumed in spraying and also to reduce the weight of the spraying equipment.

F-P3A-11

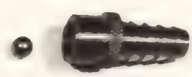
PUMP – NUMBER 3 – TYPE A

F-P3A

F-P3A-1

F-P3A-2

F-P3A-3



F-P3A-4

F-P3A-5

F-P3A-6

F-P3A-7

F-P3A-8

-P3A-9

F-P3A-10

F-P3A-11

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J. F. Breakey

Preliminary tests were made comparing the efficiency of Federal pump No. 3, Type A with Brown pump No. 1, Type A. The ease in operating the No. 3 pump may give it some advantage over pump No. 1. Any definite statement as to the comparative efficiency of the two units must await the manufacture of the No. 3 pump from materials which will permit extensive tests in the field.

3. Duraluminum pack frames. Pack frames, having the same design and outside dimensions as the regular Trapper Nelson frame, were constructed from duraluminum tubing with walls 1/32" in thickness. This material in contrast to the old wooden frames is not affected by moisture. The duraluminum frames hold their shape and do not deteriorate as fast as the wooden frames. The wooden frames are also subject to much breakage.

4. Four-gallon knapsack tanks. This experiment was devised to test three different types of sheet metal for tank construction, and to determine whether or not a small tank unit would be adequate for field spraying operations.

The metals used were 2X tin plate, 1X tin plate copper coated, and 27-gage galvanized iron. The galvanized iron was most satisfactory.

The five-gallon tank proved to be more satisfactory than the four-gallon tank on account of the frequency at which the larger volume was taken. The slight extra weight in the larger tank is not sufficient to be a handicap to the carrier.

5. Chemical application tools for treating roots and crowns of Ribes. Root and crown chemical treatment involves the finding of the crowns of the Ribes often among dense grass and brush, and the application of a highly toxic chemical to the crowns and roots of Ribes. The best results are obtained where the roots and crowns are scarified at the same time the chemical is applied.

Stakes, 14, 18, 24 and 30 inches in length, painted red with white stripes were used to mark the location of the crowns before applying the chemical solution. Then a man equipped with a knapsack unit, having an automatic trigger nozzle with a long curved spout attached (see photograph) applied the chemical to the crowns.

It was later decided to eliminate the marking of the crowns by the use of stakes. In place of this method a tool (see photograph) was devised which has a rough pronged end for uncovering the crowns and a trigger nozzle and connecting pipe for applying the chemical to the plants.

Preliminary tests were made comparing the efficiency of federal pump No. 2, Type A with brown pump No. 1, Type A. The ease in operating the No. 2 pump may give it some advantage over pump No. 1. Any definite statement as to the comparative efficiency of the two units must await the manufacture of the No. 2 pump from materials which will permit extensive tests in the field.

3. Duralumin pack frames. Pack frames, having the same design and outside dimensions as the regular Trapper Nelson frame, were constructed from duralumin tubing with walls 1/32" in thickness. This material in contrast to the old wooden frames is not affected by moisture. The duralumin frames hold their shape and do not deteriorate as fast as the wooden frames. The wooden frames are also subject to much breakage.

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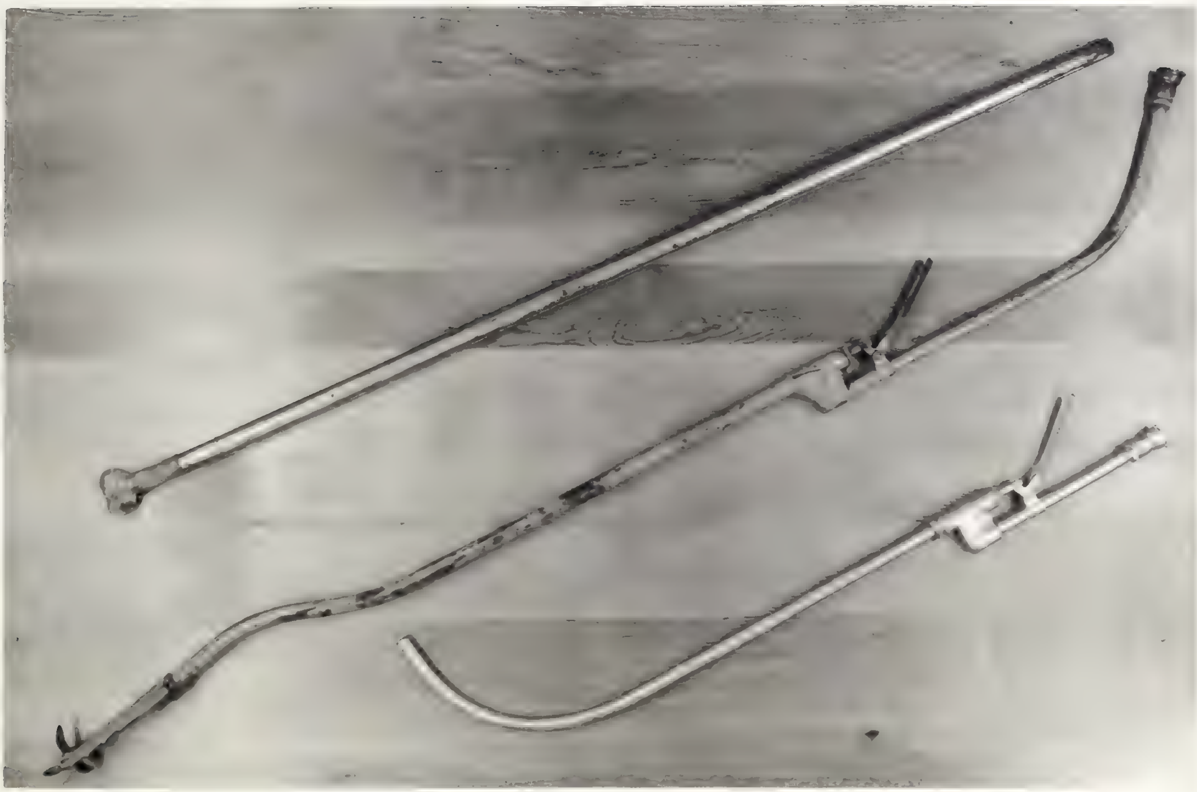
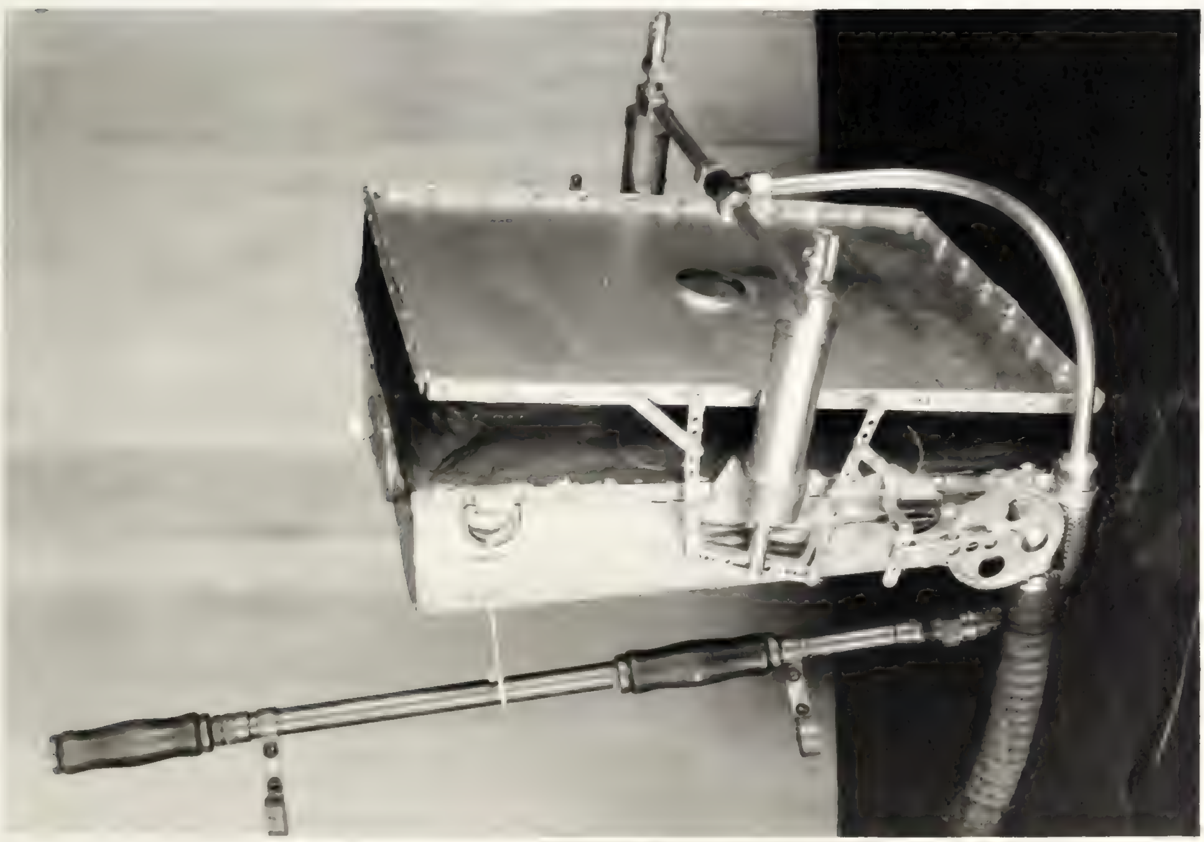
5. Chemical application tools for treating roots and crowns of Ribes. Root and crown chemical treatment involves the finding of the crowns of the Ribes often among loose grass and brush, and the application of a highly toxic chemical to the crowns and roots of Ribes. The best results are obtained where the roots and crowns are scarified at the same time the chemical is applied.

Stakes, 14, 16, 18 and 22 inches in length, painted red with white stripes were used to mark the location of the crowns before applying the chemical solution. Then a man equipped with a knapsack unit, having an automatic trigger nozzle with a long curved spout attached (see photograph) applied the chemical to the crowns.

It was later decided to eliminate the marking of the crowns by the use of stakes. In place of this method a tool (see photograph) was devised which has a rough [illegible] end for scarifying the crowns and a trigger nozzle and connecting pipe for applying the chemical to the plants.



ROOT CROWN TOOLS



DUSTER

Annual Report 1930
J. F. Breakey

Crown application of chemical sprays for destruction of Ribes is in an experimental stage and checks must be made to determine which method is most effective.

6. Dual purpose spraying equipment readily convertible to fire fighting apparatus.

a. Pump No. 2 - Type B. In fire control a pump is required with a much larger spraying capacity than the pump used in spraying Ribes. A double-acting duraluminum pump 1-5/8" in diameter was constructed to meet this requirement, but it was found to be too large for one man to operate.

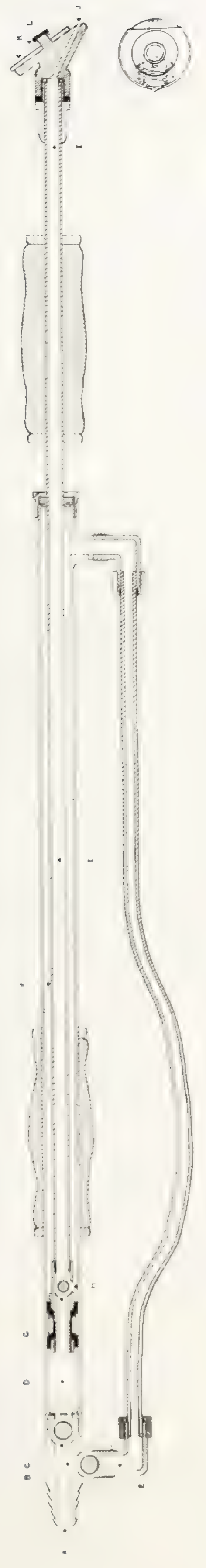
The pump, No. 2 - Type B, shown in the accompanying drawing, designed to compound the action of a double-action trombone pump, has four valve openings, a feeder pipe on the side, and two cup plunger washers operating on both the compression and expansion strokes.

Referring to the drawing, it will be seen that the operation of the pump is as follows: Water enters at A from a hose line, and on the expansion stroke of plunger the liquid is drawn into recess D at valve B. Valve C and valve G are closed. On the compression stroke valve B closes and valve C opens, valve G opens and valve H closes, and the water from recess D flows out into recess I and through nozzle orifice J. At the same time recess E extending on into recess F is filled with liquid. On the expansion stroke valve B is open and C. is closed, valve G is closed and H is open, and recess D is filled with water. Water from recess F flows out through valve H into recess I and through orifice J. This completes the operation of the pump. The same ball check operates in both valve seats G and H alternately as the plunger moves back and forth. The diameter of the barrel is 5/8" and the length of stroke is 15". The capacity of this pump is approximately 10 cubic inches.

b. Fire nozzle for hand pumps. A cross section drawing of the nozzle shown attached to pump No. 2 Type B illustrates its four parts: the aluminum base with 1/4" pipe thread for attaching to pumps, the orifice with 5/32" opening J, the brass plate K with one side cut away, and brass spring washer L. By revolving plate K which is knurled on the outside, the stream can be made either round or a flat fan shape. The direction of the stream can be changed by simply rotating the plunger of the pump.

This nozzle is designed for fire fighting. A single stream can be procured when it is necessary to throw the water up to a distance

PUMP - NUMBER 2 - TYPE B



PUMP - EXPERIMENTAL - FED. NO. 2
OFFICE OF BLISTER RUST CONTROL
U S DEPARTMENT OF AGRI
12-19-30
BY John F. Breakey

Annual Report 1930
J. F. Breakey

of 20 to 30 feet. The course fan spray is more suitable for application of the water to fire in close proximity to the worker.

STATEMENT OF COSTS

Salary.........................	$1,599.96	
Expenses.......................	151.04	$1,751.00
Cost of equipment -		
Eradication -		
Aluminum pack frame........	$36.00	
Aluminum pack frame........	36.00	
Duster.....................	411.27	
Special 4-gallon tanks.....	21.45	
Nozzle testing apparatus...	7.36	
Special trombone pump......	33.38	
Special trombone pump......	28.85	574.31
Chemical studies -		
Root-crown tools -		
Trigger valve 1/4" outlet...	$23.60	
Trigger valve 1/2" "	25.69	
Spade tool and valve 1/2" outlet..................	42.21	
Tank reconstruction.........	5.50	
Gloves......................	3.00	100.00
*Dual purpose pumps -		
Duraluminum tubing..........	35.35	
Pump No. 2 - Type B.........	44.50	
Aluminum nozzles............	15.05	94.90
Total.................................		$2,520.21

*Materials furnished by Forest Service.

RECOMMENDATIONS FOR FUTURE EXPERIMENTATION

A. Pumps

1. Federal No. 3 Type A. Continue experiments with various tubing until one is found that is strong enough to stand the field tests, and which will resist the action of chemicals.

2. Dual purpose pump No. 2 Type B. Copy the set-up of this pump but make it smaller to determine whether or not it will speed up spraying operations.

B. Duraluminum Pack Frames

Construct several light metal pack frames for a thorough field trial next season.

C. Nozzles for Power Spraying.

Use Myers nozzles with special needle valve.

D. Suitable Tool for Injecting Chemical Paste into Stems of Ribes Plants.

Devise a tool that will be practical to use for stem injections.

E. Nozzles.

Determine by tests whether or not discs other than 111 fine are needed as standard field equipment.

F. Factory Equipment.

Use every opportunity to get the factories supplying us with the major part of our equipment to build it exactly as our field requirements necessitate.

RIBES ERADICATION ON NATIONAL FORESTS

By
Herman E. Swanson
Agent

INTRODUCTION

Ribes eradication for the control of white pine blister rust was begun by the Forest Service during the 1930 field season. An allotment of $25,000 was available for the work which began July 1 and continued until September 12. Technical and administrative supervision for the field units was furnished by the Office of Blister Rust Control.

In conjunction with the Forest Service work, the Office of Blister Rust Control maintained an organization throughout the season for the purpose of developing and improving methods of Ribes eradication. The methods unit, along with its special studies, was engaged in practical control work. The principal distinction between the methods operation and that of the Forest Service was the use of power spraying equipment in the methods camp and knapsack sprayers in the Forest Service camps.

Reference should be made to the service rendered by the Ribes eradication personnel during the fire season. During the month of August, the personnel of two of the 20-man camps were called out on fire duty for a period of five days. In September, ten men were taken over to the Selway Forest for three days. Although the loss of time from eradication work prevented the completion of certain areas, this situation was more than compensated for by the help which the eradication forces were able to give at a time of emergency.

This report deals with the work done by the Forest Service camps over the period from July 1 to September 12. A summary of the work done by the methods organization is given along with the results of the Forest Service operation. For a detailed account of the work performed by the methods unit, refer to the report on chemical eradication methods.

PURPOSE

1. Partial control of white pine blister rust through the eradication of Ribes from stream type.

2. Training personnel for future work.

LOCATION AND DESCRIPTION OF AREA

The Ribes eradication activities were conducted on the Musselshell District of the Clearwater National Forest. Lolo Creek, Eldorado Creek,

RIBES ERADICATION ON NATIONAL FORESTS

by

Herman E. Swanson

Agent

INTRODUCTION

Ribes eradication for the control of white pine blister rust was begun by the Forest Service during the [illegible] field season. An allotment of $25,000 was available for the work which began July 1 and continued until September 15. Technical and administrative supervision for the field units was furnished by the Office of Blister Rust Control.

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Reference should be made to the service rendered by the Ribes eradication personnel during the fire season. During the month of August, the personnel of two of the 20-man camps were called out on fire duty for a period of five days. In September, ten men were taken over to the [illegible] forest for three days. Although the loss of time from eradication work prevented the completion of certain areas, this situation was more than compensated for by the help which the eradication forces were able to give at a time of emergency.

This report deals with the work done by the Forest Service camps over the period from July 1 to September 15. A summary of the work done by the methods organization is given along with the results of the Forest Service operation. For a detailed account of the work performed by the methods unit, refer to the report on chemical eradication methods.

OBJECTS

1. Partial control of white pine blister rust through the eradication of Ribes from stream type.

2. Training personnel for future work.

LOCATION AND DESCRIPTION OF AREA

The Ribes eradication activities were conducted on the [illegible] District of the Clearwater National Forest. Lolo Creek, [illegible] Creek,

lower Musselshell Creek, Mud Creek, Cedar Creek, Dollar Creek, the lower end of Camp Creek and the East Fork of Lolo Creek were the principal areas worked. These streams occur in townships 34 and 35 north, ranges 6 and 7 east, with the work extending slightly into township 36 north, ranges 6 and 7 east.

The ground actually eradicated of Ribes by the camp engaged on methods studies forms an integral part of the area partially protected by stream type Ribes eradication performed by the Forest Service camps.

The timber in the region in which this stream type Ribes eradication was done is for the most part mature white pine. Some immature stands exist near the southern end of the district.

Within the area where the stream type Ribes eradication was done, control measures had been carried on during the preceding spring for the suppression of the white pine beetle.

Heavy concentrations of Ribes petiolare and R. lacustre are characteristic of the Musselshell region. Some of the heaviest concentrations remaining on the Clearwater Forest were encountered. Since heavy brush conditions prevailed, the difficulty factor was high. Many of the tributaries to the main drainages were of considerable length, having R. petiolare practically to their sources. Although approximately 90 man-days were spent constructing way trails into some of these areas, it was not advisable to do so in all cases. Consequently, a large amount of chemical had to be man-packed for considerable distances.

METHODS, EQUIPMENT AND MATERIALS

The project consisted of three 20-man units, with a camp boss, cook and flunky for each camp. The size of these units was satisfactory for the type of area encountered. The wide brushy stream type with heavy Ribes concentrations made progress slower and consequently it was necessary for each camp to move but twice.

One full-time pack string of eight mules and a saddle horse was hired for supplying the camps. As needed, the regular Forest Service pack string was engaged to do that packing which the other string could not handle. This packing schedule, through the excellent cooperation of the District Ranger made a very satisfactory arrangement.

For the spraying work, a knapsack unit, consisting of a 5-gallon tank with a curved back strapped to a Trapper Nelson pack frame, was used exclusively on this project. The tanks are constructed by Spokane firms securing the contract on bid. The Trapper Nelson pack frame is manufactured by Charles Trager, Seattle, Washington. This unit had been demonstrated,

lower [illegible] Creek, [illegible] Creek, Baker Creek, Collier Creek, the lower end of Camp Creek and the last part of [illegible] Creek were the principal areas worked. These streams occur in townships 35 and 36 north, ranges 6 and 7 east, with the work extending slightly into township 34 north, ranges 6 and 7 east.

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PERSONNEL, EQUIPMENT AND SUPPLIES

The project consisted of three 40-man units, with a camp boss, cook and flunky for each camp. The size of these units was satisfactory for the type of area encountered. The wide brushy stream types with heavy Ribes concentrations made progress slower and consequently it was necessary for each camp to move but twice.

One full-time pack string of eight mules and a saddle horse was hired for supplying the camps. As needed, the regular Forest Service pack string was engaged to do that packing which the hired string could not handle. This packing schedule, through the excellent cooperation of the District Ranger made a very satisfactory arrangement.

For the spraying work, a knapsack unit, consisting of a [illegible] tank with a curved neck strapped to a Trapper Nelson pack frame, was used exclusively on this project. The tanks are manufactured by [illegible] the contract on bid. The Trapper Nelson pack frame is manufactured by Chester Trapper, Seattle, Washington. This unit has been [illegible]

during the previous field season, to be the most satisfactory of all the units tested. The flexibility of the unit and the detachable pack frame made it very practical. The pack frame is used considerably in carrying chemicals and supplies into inaccessible areas.

Brown double-action pumps, manufactured by the E. C. Brown Company, Rochester, New York, were used and were very satisfactory. Some weaknesses were found. The manufacturer, on the suggestion of this office, has made some minor changes in the construction of the pump, which make it a very strong and durable unit, one which will stand the severe treatment which results from use in the brush.

Atlacide, a commercial chemical product manufactured by the Chipman Chemical Company, Boundbrook, New Jersey, was used for spraying R. petiolare. This chemical was used in the proportion of 1.4 pounds to each gallon of water. One-half or one-third pint of a stock solution, made by dissolving one pound of flake glue in three gallons of water, was used in each ten gallons of solution to provide a spreader which would aid in distributing the spray evenly over the bushes and also causing the spray to stick.

Heavy durable tubs of 10 to 14 gallons capacity were used as mixing containers.

For knapsack spraying, the individual section system was used. This method, in which a man is assigned to an individual block of stream type, permits the greatest output of work per man. This block is usually about 100 feet in length extending across the entire stream bottom. It is divided into strips by use of 3-ply sewing twine. At suitable locations along the stream, usually adjacent to each block, filling stations are established where the chemical is mixed and the men come to fill their spray tanks. The foreman of the crew lays out the blocks with string lines and mixes the chemical. He has either three or four men spraying in his crew, depending upon the concentration of R. petiolare.

Thus far chemicals, which are adaptable to field use, have been effective on R. petiolare only. This necessitated the eradication of the other two prevalent species, R. lacustre and R. inerme, by hand pulling methods. Generally the area was covered first by a crew of three men hand pulling these species. On some areas where R. petiolare was scattered, this species was also hand pulled, eliminating the necessity of covering the ground again. However, on the main drainages, the concentrations of R. petiolare required spraying in all cases.

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Bean gentle-action pumps, manufactured by the B. C. Bean Company, Rochester, New York, were used and were very satisfactory. Some weaknesses were found. The manufacturer, on the suggestion of this office, has made some minor changes in the construction of the pump, which make it a very strong and durable unit, one which will stand the severe treatment which results from use in the field.

Atlacide, a commercial chemical product manufactured by the Chipman Chemical Company, Bound Brook, New Jersey, was used for spraying R. petiolaris. This chemical was used in the proportion of 1.5 pounds to each gallon of water. One-half of one-fourth pint of a stock solution, made by dissolving one pound of flake glue in three gallons of water, was used in each ten gallons of solution to provide a spreader which would aid in distributing the spray evenly over the leaves and also cause the spray to stick.

Heavy durable tubs of 10 to 15 gallons capacity were used as mixing containers.

For extensive spraying, the field base station system was used. This method, in which a crew is assigned to an individual block of stream type, permits the greatest output of work per crew. This block is usually about 100 feet in length extending across the entire stream bottom. It is divided into strips by use of fairly strong twine. At suitable locations along the stream, usually adjacent to each block, filling stations are established where the chemical is mixed and the men come to fill their spray tanks. The foreman of the crew lays out the blocks with string lines and mixes the chemical. He has either three or four men spraying in his crew, depending upon the concentration of R. petiolaris.

Tests for chemicals, which are adaptable to field use, have been effective on R. petiolaris only. This necessitated the eradication of the other two prevailing species, R. inerme and R. lacustre, by hand pulling methods. Generally the area was covered first by a crew of three men hand pulling these species. On some areas where R. petiolaris was scattered this species was also hand pulled, eliminating the necessity of covering the ground again. However, on the main drainages, the concentration of R. petiolaris required spraying in all cases.

STATEMENT AND ANALYSIS OF COSTS

TABLE NO. 1

STATEMENT OF EXPENDITURES

Item		Amount
Salaries	Supervision	$2,134.00*
	Temporary	8,560.96
Subsistence	Salaries of cooks	1,105.27
	Cost of food	3,741.04
	Transportation of food	401.37
General Equipment	Cost	1,345.60**
	Transportation	496.09
Spraying Equipment		365.64 #
Miscellaneous	Expenses	82.98
	Repairs	53.00
	Twine	55.00
Chemical	Cost	1,871.70
	Transportation	485.20
Transportation of men		7.50
Total		$20,706.35 ##

*Furnished by Office of Blister Rust Control.

**In calculating per acre costs, the cost of general equipment is charged off over a 3-year period.

In calculating per acre costs, the cost of spraying equipment is charged off over a 2-year period.

Cost charged against 1930 operations is $19,626.46.

TABLE NO. 2

COST OF MEALS

Item	Amount
Salaries of cooks	$1,105.27
Cost of food	3,741.04
Transportation of food	401.37
Total Cost	$5,247.68

Number of meals.............12,254

Cost per meal.............$.43

WORK PERFORMED AND RESULTS OBTAINED

TABLE NO. 3

CHEMICAL ERADICATION ON CLEARWATER NATIONAL FOREST, 1930

Method	Man-Days	Gallons Chemical	Acres Worked	Total Cost	Data Per Acre Man-Days	Data Per Acre Gallons Chemical	Data Per Acre Cost
Knapsack	935	19,689	977	$8,903.57	0.96	20.2	$9.11

TABLE NO. 4

HAND ERADICATION ON CLEARWATER NATIONAL FOREST, 1930

Type	Man-Days	Acres	Total Cost	Number Ribes Pulled					Data Per Acre		
				R. lac.	R. pet.	R. vis.	R. iner.	Total	Man-Days	Ribes	Cost
Stream	1,600	*1,909	10,122.73	410,190	41,821	10,997	29,843	492,751	0.84	258	15.30

TABLE NO. 5

ERADICATION SUMMARY ON CLEARWATER NATIONAL FOREST, 1930

Man-Days	Pounds Chemical	Acres Worked	Total Cost	Acres Partially Protected	Per Cent of Area Stream Type	Cost Per Acre to Eradicate	Cost Per Acre For Partial Protection
[illegible]	28,300	*1,909	$19,026.60	20,54[illegible]	9.3	$9.97	$.926

*The acreage sprayed had Ribes bushes other than R. petiolare hand pulled. Hence it is a part of the acreage listed under hand pulling and the two should not be added.

TABLE NO. 6

RE-ERADICATION ON CLEARWATER NATIONAL FOREST, 1930

Type	Man-Days	Acres	Total Cost	Ribes Pulled: R. lac.	Ribes Pulled: R. pet.	Ribes Pulled: Total	Data Per Acre: Man-Days	Data Per Acre: Ribes	Data Per Acre: Cost	Data Per Acre: Cost of 1st Eradication
Stream	88	246	$600.16	9,329	8,974	18,303	0.36	74	$2.44	$16.00

Note: During 1929 stream type Ribes eradication was done on the Musselshell Creek drainage. For the purpose of securing necessary cost data on power as compared to knapsack methods, all species of Ribes were sprayed. As the chemical was not fully effective on R. lacustre, and because one of the camps was advantageously located to rework a portion of this area, it was deemed advisable to do so.

TABLE NO. 7

SUMMARY OF ALL ERADICATION ON CLEARWATER NATIONAL FOREST, 1930*

Unit	Man-Days	Pounds Chemical	Acres Worked	Total Cost	Acres Partially Protected	Per Cent Area Stream Type	Cost per Acre to Eradicate Ribes	Cost per Acre for Partial Protection
Forest Service	2,535	23,900	1,909	$19,026.30	20,545	9.30	$9.97	$.926
B.R.C. Methods	1,690	12,700	1,357	13,958.41	16,200	8.40	10.28	.861
Both	4,225	36,600	3,266	$32,984.71	36,745	8.89	$10.10	$.898

*This table is shown here in order that all the eradication work performed in 1930 on the Clearwater National Forest might be summarized.

DISCUSSION AND ANALYSIS

A comparison of the results of work done by the three Forest Service camps and the methods unit, as shown in table No. 7, demonstrates a significant fact. A higher per acre cost for acres worked is shown for the methods camp, but a lower cost per acre partially protected. The classifications upon which these costs are based refer to the actual acreage from which Ribes were eradicated in the first case, and the acreage partially protected represents the total area surrounding a particular

PRELIMINARY RIBES ERADICATION SURVEY ON CLEARWATER NATIONAL FOREST, 1930

TABLE NO. 8

STREAM TYPE RIBES ERADICATION

Region	Size of Camp	Tons of Chemical	Total Cost
Orofino Creek Drainage	20-man	3¼	$8,000
French Creek Drainage	15-man	2½	$8,000
East and South Forks of French Creek	12-man	2¼	$6,000
Orogrande Creek (including side tributaries from south and east)	20-man	7½	$9,000
Township 38 north, range 7 east (area north and west of Orogrande Creek)	2 - 15-man	11½	$13,000

A very extensive survey was made of the stream type conditions on the Canyon District. Examination of the Larsen Creek, Rock Creek, Quartz Creek, Skull Creek and Isabella Creek drainages indicated that the Ribes on these streams were so scattered that stream type eradication alone would be impractical and that any eradication work performed on these areas should include the working of both stream and hillside.

A very extensive survey was made of the stream type conditions on the Canyon District. Examination of the Carson Creek, Bear Creek, Quartz Creek, Small Creek and Isabell's Creek drainages indicate that the Ribes on these streams were so scattered that stream-type eradication alone would be impractical and that any eradication work performed on these areas should include the working of both stream and hillside.

drainage which is relieved of a great proportion of the hazard from the blister rust by stream type eradication. For power spraying, the heaviest concentrations were selected. This accounts for the higher cost per acre worked by the methods camp. However, the percentage of stream type on the areas worked by the other camps was greater, which necessitated the working of a larger acreage to give partial protection to the surrounding area. Consequently the cost chargeable against this acreage was higher.

The cost of stream type eradication as charged against the acreage partially protected for the Musselshell District seems to be constant. The average cost per acre for the area protected in 1929 on Musselshell Creek was $.89 and for the 1930 operation it was $.895.

CONCLUSIONS

1. For stream type eradication, a 2[illegible]-man camp represents the largest unit which it is advisable to put in the field. On heavy Ribes concentrations as found on the Musselshell District, this size of unit was satisfactory. Where Ribes conditions are lighter, a smaller camp unit, probably about 15 men, would be more satisfactory. Such a unit would not be making so many camp moves.

2. During the year following initial eradication, a clean-up operation should be made on the sprayed areas. There is some survival of R. petiolare which is sprayed. These bushes can be easily destroyed by a re-spray. It is estimated that a crew of three or four men can do this clean-up work on the entire sprayed area covered in 1930 on the Musselshell District.

3. The knapsack spraying equipment from two camps was taken to a fire. It was used to great advantage in retarding the spread of the fire and for putting out spot fires and burning snags. With due care in the transporting of this equipment to and from the fire, this use has no detrimental effects on the equipment. When occasion demands, further use of the spraying equipment is recommended for fighting fires.

drainage which is believed of a great proportion of the Russell from the blister rust by stream type eradication. For power spraying, the heaviest concentrations were selected. This accounts for the higher cost per acre worked by the hydraulic camp. However, the percentage of stream type on the areas covered by the other method was greater, which necessitated the working of a larger acreage to give partial protection to the surrounding area. Consequently the cost chargeable against this acreage was higher.

The cost of stream type eradication as charged against the acreage partially protected for the Russelshell district seems to be constant. The average cost per acre for the area protected in 1937 on Russelshell Creek was 1.82 and for the 1938 operation it was [illegible].

CONCLUSIONS

1. For stream type eradication, a 25-man camp represents the largest unit which it is advisable to put in the field. On heavy Ribes concentrations as found on the Russelshell district, this size of unit was satisfactory. Where Ribes conditions are lighter, a smaller camp, preferably about 15 men, would be more satisfactory. Larger camps would not be making so many camp moves.

2. During the year following initial eradication, a clean-up operation should be made on the sprayed areas. There is some survival of R. petiolare which is sprayed. These bushes can be easily destroyed by re-spraying. It is estimated that a crew of three or four men can do this clean-up work on the entire sprayed area covered in 1938 on the Russelshell district.

3. The hampeach spraying equipment from the camps was taken to a fire. It was used to great advantage in retarding the spread of the fire and for putting out spot fires and burning snags. Aside from wear in the transporting of this equipment to and from the fire, this fire had no detrimental effects on the equipment. When occasion demands, further use of the spraying equipment is recommended for fighting fires.

PRELIMINARY RIBES ERADICATION SURVEY OF THE PALOUSE DIVISION OF THE ST.JOE NATIONAL FOREST

By
W. G. Guernsey, Junior Forester
and
H. Hartman, Agent

INTRODUCTION

A preliminary survey was made of the Palouse Division of the St. Joe National Forest during the latter part of September, 1930. This inspection was instigated by the Office of Blister Rust Control in view of the possibility of a local control program being carried on in that region during 1931.

There is a considerable amount of white pine of the younger age classes represented in the area. This fact will no doubt encourage the early working of the area to insure timely protection measures.

It has been found that a large portion of the area is owned by private holders with some Forest Service lands intermingled. This makes the advance of the necessary funds to carry on the work problematical, depending upon the cooperative effort of the numerous interested parties.

PURPOSE OF SURVEY

1. To obtain such information on the area as is necessary for planning the field organization and methods of Ribes eradication when funds are available.

2. To obtain information on which to base an estimate of the amount of spraying equipment necessary and the amount of general equipment and chemicals required on the area.

LOCATION AND DESCRIPTION OF THE AREA

The Palouse Division of the St. Joe National Forest is located in townships 41, 42, 43 and 44 north, ranges 1,2,3,4, and 5 west, Boise Meridian.

In general the area is characterized by valuable white pine and western yellow pine stands. The larger portion of these stands is in the advanced reproduction and pole stages.

TABLE NO. 1

RESULTS OF WORK

Stream Type Area to be Hand Eradicated of Ribes		Stream Type Area to be Sprayed with Chemical	
Class	Acres	Class	Acres
B	4,300	L	31
C	4,360	M	43
D	182	H	0
Total	8,658	Total	74

In addition to the data shown in Table No. 1 on stream type, the area known as the Idaho Forest School Experiment Forest located in the Palouse Division was inspected. There are a few Ribes in all the timber types on the area that can be eradicated at a low cost per acre.

It is estimated that three and one-half tons of chemical will be necessary, to effectively cover the R. petiolare on the Palouse Division of the St. Joe, and this quantity of chemical will also take care of the protective zone around the forest. The amount of chemical mentioned is derived by consideration of the number of days and quantity of chemical necessary to spray similar adjacent stream type areas on the Potlatch Timber Protective Association lands.

CONCLUSION

The area on the Palouse Division that should be given the degree of protection afforded by the eradication of Ribes in the stream type amounts to 162,780 acres.

It is estimated by the preliminary survey crew that approximately 4,000 working days and an expenditure of 25,000 dollars will be necessary to cover the area. This estimate was reached after a compilation of estimates by drainages and a comparison of expenditures and the number of man days required for similar areas worked in the past.

PRELIMINARY RIBES ERADICATION SURVEY
PRIEST RIVER EXPERIMENT STATION
1930.

By

C. C. Strong
Associate Forester

White pine blister rust is now firmly established in Idaho. Although no blister rust, either on Ribes or white pines, has yet been found within about 5 miles of the Priest River experimental forest, there is no reason to believe that it will not soon become established on this area or that it might not already be present. Many investigations are under way on the experimental forest with which the advent of blister rust would doubtless play havoc. For this reason the Director of the Northern Rocky Mountain Experiment Station requested the personnel of the Office of Blister Rust Control to make a preliminary survey of the area to determine what area would have to be cleared of Ribes to protect the pines on the forest and the probable cost of such work.

RIBES CONDITIONS

The bulk of the experimental forest is included in the Benton and South Fork of East River drainages. Ribes conditions are not severe with certain small burns excepted.

The Lower East River drainage was found to contain very extensive areas of heavy brush through which a tangled mass of Ribes inerme is generally distributed. It is extremely doubtful if the white pine on lower Benton Creek and the lower portion of the South Fork of East River could be given adequate protection without the removal of Ribes from East River to a point about one mile northeast of the bridge on the Priest River-Coolin road.

ESTIMATED COST OF RIBES ERADICATION

By hand pulling methods it is estimated that it will cost not less than $1,500.00 to work once over the East River area necessary to be worked. However, hand pulling is so ineffective for permanently suppressing R. inerme where it is present in such masses, it would seem better to let this area wait a year pending the field testing of new methods of killing Ribes with chemicals which show promise of doing the job much more effectively and at a much lower cost than results from hand pulling.

The Benton Creek and South Fork of East River drainages are adapted to hand pulling methods only and the work can be done at any time. It is estimated that $5,000.00 will be sufficient to cover this area plus a small amount of area bordering which would serve as a protective strip. That area (Big Creek drainage) immediately to the south of the experimental forest, already having been worked, will serve as a protection zone.

W.323 - Ribes inerme growing entwined with brush - willows in this instance. Typical of R. inerme. It is very difficult to do an effective eradication job on R. inerme in such a situation.

W.380 - Thrifty stand of western white pine on the South Fork of Reed's Creek on the C.T.P.A. The value of protection of pine from white pine blister rust in such stands is beyond question.

COOPERATIVE LOCAL CONTROL, CLEARWATER TIMBER PROTECTIVE ASSOCIATION

By
B. A. Anderson,
Junior Forester

INTRODUCTION

One of the reasons for selecting the Reed's Creek drainage upon which to start the control program in 1929 was the finding of blister rust infections on the leaves of *Ribes petiolare* near Headquarters, Idaho. During the summer of 1929 pine infections were found in the same drainage and in 1930 scouting work revealed four additional pine infection centers on Clearwater Timber Protective Association lands. These infections were found on:

1. North Fork Reed's Creek, near Headquarters, township 38 north, range 5 east, section 15.

2. Quartz Creek near Headquarters, township 37 north, range 5 east, section 5.

3. Rhodes Creek near Pierce, township 36 north, range 5 east, section 13.

4. Orofino Creek near Pierce.

Of these the Quartz Creek area is perhaps the most heavily infected. On this area discovery of the rust on *R. petiolare* led to a careful examination of the pines in the immediate vicinity which disclosed dozens of cankers. The cankers were probably of 1927 origin. No fruiting cankers were found but the heavy infections found on currants are an almost certain indication that a closer search would disclose some in the immediate vicinity. The stream type on this area was cleared of all Ribes a few days after the discovery of the infection.

After the eradication camps were closed in the fall of 1929 a preliminary Ribes eradication survey was made on the unworked tributaries of Reed's Creek. Information regarding Ribes conditions and possible camp sites was secured.

In 1930 a much larger number of men were employed on blister rust work on the Clearwater Timber Protective Association than in 1929, the force being increased by about half.

PURPOSES OF WORK

1. To continue complete eradication of all Ribes in the stream type of white pine areas to control white pine blister rust.

2. To develop personnel for future work.

LOCATION AND DESCRIPTION OF AREA

Stream type Ribes eradication was completed on 21,500 acres in the upper Reed's Creek drainage in 1929. During 1930 the same type of work was continued and completed on Reed's Creek and all its tributaries, Big Slide and Evans creeks, Poorman Creek with all its tributaries, and the headwaters of Quartz Creek from the mouth of Beaver Creek in township 37 north, range 5 east.

These drainages include the southern portion of township 39 north, ranges 4 and 5 east, all of township 38 north, ranges 4 and 5 east, a portion of the northeast of township 37 north, range 4 east, and a portion of the west half of township 37 north, range 5 east.

R. petiolare did not occur as heavily on the areas worked this year as it did on the headwaters of Reed's Creek. Very few R. petiolare bushes were found on Slide, Evans, Big, Ruby and Gold creeks or on the lower seven miles of Reed's Creek. Relatively few R. petiolare bushes were found on Poorman Creek. Heavy concentrations, however, were found on Casey and Meadow creeks, all of Parallel Creek and the upper reaches of Reed's, Snake and Quartz creeks.

R. inerme, the white-stemmed gooseberry, was found in only one locality in heavy concentrations - on Meadow Creek above the old dam near the township line.

R. lacustre bushes were scattered generally over all of the area. A few bushes of R. irriguum were found on lower Snake Creek.

Practically all of the area is covered with fine stands of white pine. Logging has been done on part of the Big, Slide and Evans creek areas and also on part of the Quartz Creek drainage. The cut has been made on a sustained yield basis, all slashings and debris have been piled and burned.

The topography of lower Reed's Creek is much more rugged than its headwaters. For approximately eight or nine miles from its mouth, Reed's Creek flows through what might almost be designated as a canyon. Very little stream type is found along the creek, the slopes on each side rising almost precipitously from the stream.

On lower Reed's Creek east of Big Island there is a rather extensive area which was burned over several years ago. The entire drainage of Christmas Creek, a tributary of Gold Creek, has been burned over, the fire occurring about the same time as the lower Reed's Creek fire.

LOCATION AND DESCRIPTION OF AREA

Blister type Ribes eradication was completed on 21,000 acres in the upper Reed's Creek drainage in 1933. During 1935 the same type of work was continued and completed on Reed's Creek and all its tributaries, Big Elk and Evans creeks, Freeman Creek with all its tributaries, and the headwaters of Quartz Creek from the mouth of Beaver Creek in township 37 north, range 2 east.

These drainages include the southern portion of township 38 north, ranges 4 and 5 east, all of township 38 north, ranges 4 and 5 east, a portion of the northeast of township 37 north, range 4 east, and a portion of the west half of township 37 north, range 5 east.

R. petiolare did not occur as heavily on the areas worked this year as it did on the headwaters of Reed's Creek. Very few R. petiolare bushes were found on Elk, Evans, Big, Ruby and Gold creeks or the lower seven miles of Reed's Creek. Relatively few R. petiolare bushes were found on Freeman Creek. Heavy concentrations, however, were found on Casey and Basin creeks, all of Parallel Creek and the upper reaches of Reed's, Snake and Quartz creeks.

R. inerme, the white-stemmed gooseberry, was found in only one locality in heavy concentrations - on Beaver Creek above the old dam near the township line.

R. lacustre bushes were scattered generally over all of the area. A few bushes of R. irriguum were found on lower Gold Creek.

Practically all of the area is covered with fine stands of white pine. Logging has been done on part of the Elk, Gold and Evans Creek areas and also on part of the Quartz Creek drainage. The cut has been made on a sustained yield basis, all slashings and debris have been piled and burned.

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On lower Reed's Creek east of Big Island there is a rather extensive area which was burned over several years ago. The entire drainage of Christmas Creek, a tributary of Gold Creek, has been burned over, the fire occurring about the same time as the lower Reed's Creek fire.

METHODS AND EQUIPMENT

The men were divided into four 15-man units. These units were smaller than the units used in 1929. The change in the size of camps was made because of the relative immobility of the larger camp. In a region where fewer Ribes are found it is necessary to move camp from three to six times a season. Mobility of units in such cases is of paramount importance.

A pack string of 8 mules was used to move camp equipment, distribute grub supplies and chemical to camps which could not be reached by truck. A half-ton Chevrolet truck was used to handle supplies for those camps located on roads. During the latter part of the season it was found necessary to press into service a ton and a half truck. Camps were so located that back country which could be reached only by pack string was worked during the first part of the season. Thus it was possible to dispense with the pack string about the 20th of August. When required, a pack string was secured from the Clearwater Timber Protective Association.

The Clearwater Timber Company furnished warehouse space for supplies at Headquarters, Idaho.

A. Hand-pulling Methods

At the present time it is possible to get a 100 per cent kill on only one species of Ribes, R. petiolare, with but one application of chemical. Therefore it is necessary to hand pull all other species. Scattered R. petiolare bushes are hand pulled.

Men are divided into 3-man crews with the foreman working in the center of the line where he can keep somewhat of a check on the kind of work being done by the other men. Crew strips are marked by string. 3 and 4-man crews have been found to give better efficiency than the larger crews.

B. Knapsack Spraying

During hand pulling all concentrations of R. petiolare were located and later chemical crews sprayed these bushes with a 10 per cent solution of Atlacide. Very little $NaClO_3$ was used. Chemical crews were composed of three crewmen and a foreman, the foreman mixing the chemical and laying the boundaries of individual blocks and strips for the men.

WORK PERFORMED AND RESULTS

Table No. 1 is a summary of the hand-pulling work and Table No. 2 is a summary of the chemical work on the Clearwater Timber Protective Association.

METHODS AND EQUIPMENT

The men were divided into four 4-man units. These units were smaller than the units used in 1937. The change in the size of camps was made because of the relative immobility of the larger camps. In a region where fewer blisters are found it is necessary to move camp from three to six times a season. Mobility of units in such cases is of paramount importance.

A pack string of 7 mules was used to move camp equipment, distribute grub supplies and chemical to camps which could not be reached by truck. A half-ton Chevrolet truck was used to handle supplies for those camps located on roads. During the latter part of the season it was found necessary to press into service a ton and a half truck. Camps were so located that back country which could be reached only by pack string was worked during the first part of the season. Thus it was possible to dispense with the pack string about the 20th of August. When required, a pack string was secured from the Clearwater Timber Protective Association.

The Clearwater Timber Company furnished warehouse space for supplies at Headquarters, Idaho.

a. Hand-pulling Methods

At the present time it is possible to get a 100 per cent kill on only one species of Ribes, R. petiolare, with the one application of chemical. Therefore it is necessary to hand pull all other species. Scattered R. petiolare bushes are hand pulled.

Men are divided into 5-man crews with the foreman working in the center of the line where he can keep some sort of a check on the area of work being done by the other men. Crew strips are marked by string. Small 4-man crews have been found to give better efficiency than the larger crews.

b. Chemical Spraying

During hand pulling all concentrations of R. petiolare were located and later chemical crews sprayed these bushes with a 10 per cent solution of atlacide. Very little $NaClO_3$ was used. Chemical crews were composed of three crewmen and a foreman, the foreman mixing the chemical and laying the boundaries of individual blocks and strips for the men.

WORK PERFORMED AND RESULTS

Table No. 1 is a summary of the hand-pulling work and Table No. 2 is a summary of the chemical work on the Clearwater Timber Protective Association.

W.375 - Photograph taken in 1930 of an area of Ribes petiolare sprayed in 1929 with a 10% solution of Atlacide. An almost 100% kill was secured. Two living twigs can be seen, one in the left and the other in the right hand corner of the picture. Follow-up operations the following year will catch these shoots.

W.384 - Photograph taken in 1930 of an area of Ribes petiolare sprayed with 10% solution of Atlacide in 1929. A complete kill was secured although a portion of the bushes was immersed in water during the spraying operation.

Two operations are necessary on sprayed areas. The ground is first worked by the hand-pulling method in order to remove those species of Ribes which are not susceptible to chemicals; later the knapsack crews cover the same ground to spray _R. petiolare_. The total acreage shown in Table No. 1 as hand pulled, 3,066 acres, therefore includes the 537.85 acres worked by the spraying method.

TABLE NO. 1

RESULTS BY THE HAND-PULLING RIBES ERADICATION METHOD

Camp No.	Acres Worked	Ribes Eradicated							Total	
		R. irrig.	R. lac.	R. iner.	R. pet.	R. vis.	Total	Per Acre	Man-Days	Acres Per Man-Day
1	891.00	5,248	114,224	23,773	4,488		147,733	165.8	637.00	1.40
2	1,011.20		161,291	4,392	2,507		168,190	166.3	634.75	1.59
3	518.80	65	185,043	4,686	3,403	2,923	196,120	378.0	578.00	.90
4	633.95		89,920	27,238	373	1,250	118,781	187.4	553.35	1.15
Totals or Averages	3,054.95	5,313	550,478	60,089	10,771	4,173	630,824	206.5	2,403.10	1.27

TABLE NO. 2

RESULTS OF RIBES ERADICATION BY SPRAYING METHODS ON CLEARWATER TIMBER PROTECTIVE ASSOCIATION

Camp Number	Eradication Classes														
	Light					Medium					Heavy				
	Man-Days	Acres	Gals. Spray	Acres Per Man-Day	Gals. Spray Per Acre	Man-Days	Acres	Gals. Spray	Acres Per Man-Day	Gals. Spray Per Acre	Man-Days	Acres	Gals. Spray	Acres Per Man-Day	Gals. Spray Per Acre
1	29.75	15.50	579	0.52	37.35	82.75	36.0	1,941	0.44	53.92	39	11.0	1,242	0.28	112.91
2	165.12	144.70	2,193	0.88	16.16	151.00	74.3	3,252	0.49	43.77	67	16.4	1,701	0.24	103.72
3	45.00	29.50	625	0.66	21.19	103.75	46.1	2,630	0.44	57.05					
4	177.25	133.15	2,753	0.75	20.68	53.00	30.2	1,082	0.57	35.83	4	1.0	126	0.25	126.00
Totals or Averages	417.12	322.85	6,150	0.77	19.05	390.50	186.6	8,905	0.48	47.72	110	28.4	3,068	0.26	108.03

Camp Number	Total				
	Man-Days	Acres	Gals. Spray	Acres Per Man-Day	Gals. Spray Per Acre
1	151.50	62.50	3,762	0.41	60.19
2	383.12	235.40	7,146	0.61	30.36
3	148.75	75.60	3,255	0.51	43.06
4	234.25	164.35	3,960	0.70	24.09
Totals or Averages	917.62	537.85	18,123	0.59	33.70

*The acreage sprayed had Ribes bushes other than _R. petiolare_ hand pulled. Hence it is a part of the acreage listed under hand pulling and the two should not be added.

STATEMENT AND ANALYSIS OF COSTS

TABLE NO. 3

COST OF OPERATIONS

Item		Total Cost
Salaries	Supervisors	$ 2,472.76
	Temporary men	14,902.38
Subsistence	Salaries of cooks	1,779.88
	Cost of food	5,506.19
	Transportation of food	697.95
General Equipment	Cost	660.68
	Transportation	574.07
Spraying Equipment	Cost	413.85
Miscellaneous	Supplies	105.47
	Expenses	196.76
	Repairs	17.06
	Twine	75.95
Chemical	Cost	2,088.00
	Transportation	614.00
Transportation of men		507.54
Total		$30,612.31

The above table shows the actual expenditures by eradication forces on the Clearwater Timber Protective Association lands for the period May 1 to October 31, inclusive. This period includes the actual eradication period and also the time necessary for preliminary Ribes eradication survey in the fall.

For the actual Ribes eradication work two dollars of Federal money was spent for each dollar of Association funds. Upon this basis the Bureau of Plant Industry expended $20,000 and the Association $10,000 for this work.

Upon the basis of $30,000* allotment of funds in 1930, Ribes were removed from 3,055 acres of stream type at a cost of $9.82 per acre of stream bottom actually worked and $0.49 per acre for the total area (61,000 acres) to which this type of protection was applied. The material decrease in cost per acre secured in 1930 was due to (1) more favorable working conditions, and (2) better efficiency in methods.

*It will be noted that this does not check with the actual expenditures shown in the table. In 1929 all the cooperative funds were not expended. It therefore became necessary to expand, in 1930, the regular allotment plus the amount of the deficit in 1929. Since the full $30,000 was used as the cost of the job in 1929 it was deemed best to use $30,000 as the actual cost of the work in 1930.

TABLE NO. 4

MEAL COSTS

Camp No.	Items				Number Meals Served	Average Cost Per Meal
	Salaries of Cooks	Food Costs	Transp. of Food	Total Cost		
1	$ 444.50	$1,394.96	$174.49	$2,013.95	4,285	$0.470
2	444.03	1,337.82	174.49	2,006.34	4,700	0.427
3	444.42	1,304.31	174.49	1,923.22	4,158	0.462
4	446.93	1,106.26	174.48	1,727.67	4,047	0.427
Totals or Averages	$1,779.88	$5,193.35	$697.95	$7,671.18	17,190	$0.446

In figuring food costs a reduction of $312.84, the value of food on hand at the end of the field season, was made from the total grub cost of $5,506.19.

Regular flunkies were not used. One man in each camp was picked to help with flunky work for two hours each night and Sundays, for which he was paid approximately $10 a month additional.

DISCUSSION AND ANALYSIS

1. Meal costs were a few cents less than in 1929 but a greater saving can undoubtedly be made. Heretofore green stuff has been purchased through local stores. About the middle of the season arrangements were made to buy green stuff direct from growers, delivered by them to Headquarters, Idaho. This arrangement proved more satisfactory.

2. 15-man units proved very satisfactory for stream type eradication because of the frequent moves; each camp moving from two to four times during the season. When hillside eradication is started it will probably be advisable to use a larger unit.

3. R. inerme offers a special problem. So far it has been found impossible to secure more than a 50 per cent kill by spraying on this species. A rather dense patch of R. inerme occurred on Meadow Creek growing along the stream in a mixture of willows and timothy. The patch was hand pulled but it is quite certain that it did little permanent good. An inspection of this area within a year or so will probably reveal much R. inerme regrowth.

RECOMMENDATIONS

1. At the present rate of progress it will take four or five years

[illegible]

Camp No.	Salaries of cooks	Food Costs	Transp. of food	Total Cost	Number meals served	Average Cost per meal
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals or averages	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

In figuring food costs a reduction of [illegible], the value of food on hand at the end of the field season, was made from the total grub cost of [illegible].

Regular flunkies were not used. One man in each camp was placed to help with flunky work [illegible], for which he was paid approximately [illegible].

[illegible]

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RECOMMENDATIONS

1. At the present rate of progress it will take [illegible]

to complete stream type Ribes eradication on the Clearwater Timber Protective Association. Every effort should be made to complete that type of protection as soon as possible.

2. It is very difficult to locate camps in the back country during the early part of the season because of the generally impassable condition of side roads in the Clearwater district. If camps were started in the spring where they could be reached by truck and moved to the back country later in the year, considerable trouble in starting all camps could be avoided.

3. A closer check on camps could be made (which would greatly aid the supervisor of the eradication work) if telephones were placed in each camp. On the Clearwater Timber Protective Association district it would seldom be necessary to lay more than two miles of emergency wire to tie into Association lines. Telephones in the camps would also help the Association fire warden in securing aid in cases of emergency.

4. A small cache of fire tools in each camp would also be a step forward in placing blister rust camps in a position to aid the fire warden.

PRELIMINARY RIBES ERADICATION SURVEY ON THE CLEARWATER TIMBER PROTECTIVE ASSOCIATION

After the eradication camps were closed in the fall four men spent a week making a preliminary survey of areas which will probably be worked during the 1931 field season.

In making this survey particular attention was given to the accessibility of the area, species, concentrations and distribution of Ribes and various factors which might influence the difficulty of eradicating the Ribes from the area. Possible camp sites were picked out and the various drainages divided into probable unit areas.

A considerable amount of information regarding the creeks about Pierce was obtained directly from the scouting organization.

The essential facts gained by the preliminary survey are shown in Table No. 5.

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A considerable amount of information regarding the areas about Ribes was obtained directly from the Association organization.

The essential facts gained by the preliminary survey are shown in Table No. 8.

TABLE NO. 5

PRELIMINARY STREAM TYPE ERADICATION SURVEY

Drainage	Time Needed To Work Area With 20-Man Unit	Amount of Chemical Needed on Basis of 1.4# Atlacide to 1 Gal. of Spray	Estimated Cost to Work Stream Type
Silver Creek	6 months	7½ tons	$ 17,000.00
Elkberry Creek	2 months	1 ton	$ 6,000.00
Shanghai Creek	1 month	1½ tons	$ 2,800.00
Quartz Creek	1¼ months	1¼ tons	$ 3,500.00
Trail and Beaver Creeks	1 month	1 ton	$ 2,700.00

Information regarding Ribes conditions on Canal Gulch and Rhodes creeks was secured also but more data will be necessary before cost estimates can be made for those units.

[illegible]

W.410 - Ribes petiolare being sprayed by crewman on the Potlatch Timber Protective Association.

W.429 - Ribes petiolare that was sprayed about fifteen days prior to taking of picture on the Potlatch Timber Protective Association.

COOPERATIVE LOCAL CONTROL

POTLATCH TIMBER PROTECTIVE ASSOCIATION

by

W. G. Guernsey
Junior Forester

INTRODUCTION

The eradication of wild currants and gooseberries in stream type was continued during the 1930 season on the Potlatch Timber Protective Association. Large areas were encountered which had few Ribes. Rapid progress was made on these areas by the smaller sized camps which were easily transported by pack string. In fact, the great distance supplies and equipment were packed at a minimum of expense from the central warehouse at Elk River aids in encouraging the local control program in the more inaccessible white pine areas.

The continuance of Ribes eradication in the stream type of the Potlatch Timber Protective Association on the present financial basis points to the completion of first working by 1932.

PURPOSE OF WORK

The purposes of the 1930 work in the practical eradication of the hosts of white pine blister rust on the Potlatch Timber Protective Association were:

1. To continue complete eradication of all Ribes in the stream type of white pine areas.

2. To continue the application of the control program on private and state lands and to develop a personnel for future work.

LOCATION AND DESCRIPTION OF THE AREAS

The areas worked in the 1930 season are shown on the Potlatch Timber Protective Association's eradication working unit map. The working units completed are as follows: 5,6,7, 8,9,10, 13,14,15,16, 20,21 and 24 with a total area partially protected of 147,443 acres. The units protected in part are the eastern portions of 17, 18 and 19 with a total acreage of 14,560. The north part of unit 4 and the lower portion of unit 22 were worked to the extent of 3,500 acres, embracing Partridge Creek and the territory three-quarters of a mile north of Elk River, Idaho, on Elk Creek. The total area partially protected on the Association lands for 1930, comprising all units amounts to 155,000 acres. All the units on which work was performed during the season were characterized by having a large percentage of white pine of all age classes present.

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METHODS, EQUIPMENT AND MATERIALS

The general methods, items of equipment and chemicals used were explained in detail in the introductory notes of the eradication report for 1929. Similar methods, items of equipment and chemicals were used during the 1930 season with practically no change. The operation was increased in size from two to four camps.

A one and one-half-ton capacity Chevrolet truck, purchased in the spring of 1930, was used to transport supplies and equipment.

A pack string, consisting of ten mules and a saddle horse, was hired to transport supplies and equipment to camps on areas far from roads.

Through the generosity of the officials of the Potlatch Timber Company at Elk River, Idaho, no charge was madefor the warehouse used as headquarters for stabling the pack animals and storing supplies.

WORK PERFORMED AND RESULTS OBTAINED

TABLE NO. 1

SUMMARY OF RESULTS OF RIBES ERADICATION IN STREAM TYPE BY HAND PULLING METHODS ON THE POTLATCH TIMBER PROTECTIVE ASSOCIATION LANDS

Working Unit No.	Number Ribes Pulled: R. lacustre	R. visco.	R. pet.	R. inerme	Total	Man Days: Checkman	Foreman	Acres	Ribes per Acre
5	79,932	213	1,703	-	81,848	145	75	612.4	133
6	15,915	24	192	-	16,131	33	18	145.1	111
7-8	24,575	2,672	4,050	-	31,297	72	39	207.1	151
9	243	228	-	-	471	13	17	274.5	1.6
10	283,342	34,378	7,563	28,425	353,713	646	326	1,731.7	204
13	159,340	1,010	42,667	-	203,017	160	80	487.0	417
15	154,400	913	110,276	-	265,589	135	100	801.2	332
16	4,986	3,355	9,534	-	17,875	70	28	293.5	61
*17	2,780	167	1,932	-	4,879	33	11.5	84.6	57
*18	29,609	133	21,788	-	51,530	115	52	155.3	332
*19	40,957	2,752	16,108	-	59,817	151	76	328.7	182
20	38,400	171	31,246	-	69,817	162	71	305.7	227
21	104,499	1,231	42,793	-	148,523	209	90	847.0	175
*22	79,571	17,369	8,572	18,620	124,132	217	81	445.0	279
Tot.	925,744	84,716	318,130	47,045	1,426,635	2,295	1,073.5	6,747.4	211

*Working units not completed.

TABLE NO. 2

SUMMARY OF RESULTS OF SPRAYING RIBES PETIOLARE IN STREAM TYPE ON THE POTLATCH TIMBER PROTECTIVE ASSOCIATION LANDS

Grad. Class	Working Unit No.	Man-Days	Acres	Gallons	Gallons Per Acre
M	7	79	96.2	1,703	17.7
L	10	18	14.0	291	20.7
M	10	359	208.7	8,168	39.1
H	10	123	43.9	3,253	74.0
L	22	19	24.0	360	15.0
M	22	165	97.5	4,183	42.9
Total		772	484.3	17,960	37.0

A. General Statement and Analysis of Costs of Ribes Eradication on the Potlatch Timber Protective Association Lands.

TABLE NO. 3

COST OF OPERATION

Item		Cost				
		Camp No. 1	Camp No. 2	Camp No. 3	Camp No. 4	Total
Salaries	Supervisors	$ 509.24	$ 509.24	$ 509.24	$ 509.24	$ 2,036.96
	Temporary Men	5,047.14	3,250.52	4,559.71	3,730.83	16,588.20
Subsistence	Cooks' salaries	524.77	332.17	422.50	366.00	1,645.44
	Cost of food	1,409.55	684.52	1,165.07	1,089.02	4,348.26
	Transp. of food	343.07	263.07	343.07	343.07	1,292.28
General Equip.	Cost	160.01	160.01	160.01	160.01	640.04
	Transportation	152.65	152.65	152.65	152.65	610.60
Spraying Equipment		152.46	50.82			203.28
Miscellaneous	Supplies	20.96	20.96	20.96	20.96	83.84
	Expenses	16.00	16.00	16.00	16.00	64.00
	Repairs	10.00	10.00	10.00	10.00	40.00
	Twine	28.00	28.00	28.00	28.00	112.00
Chemical	Cost	1,400.00	364.00			1,764.00
	Transportation	61.92	20.64			82.56
Total		$9,835.77	$5,862.70	$7,387.21	$6,425.78	$29,511.46

It will be noted that there is a rather wide range in total cost of the various units. This is accounted for by the fact that the units ranged in size from 17 to 25 men and that practically all the chemical was used in Camp 1.

B. Cost of Eradicating Ribes from Stream Type by Eradication Working Units.

The average cost is $4.37 for the actual stream type acreage covered. The 155,000 acres partially protected by stream type eradication of Ribes was $0.18 per acre.

TABLE NO. 4

COST OF ERADICATION

Working Unit No.	Hand Eradication			Chemical Eradication			Total Acreage	Total Cost	Cost Per Acre
	Acreage	Total Ribes	Ribes Per Acre	Acreage	Gals. Spray	Gals. Per Acre			
5	512.4	81,649	133				512.4	$ 1,468.60	$2.39
6	145.1	16,131	111				145.1	348.13	2.39
7-8	207.1	31,297	151	96.2	1,703	17.7	207.1	1,393.47	6.72
9	304.5	491	1.6				304.5	242.05	0.79
10	1,731.4	353,713	204	266.6	11,712	43.9	1,731.7	11,190.53	6.46
13	487.0	203,317	417				487.0	1,733.80	3.56
15	801.2	265,589	332				801.2	2,290.50	2.95
*16	293.5	17,975	61				293.5	659.74	2.24
*17	84.6	4,879	57				84.6	301.72	3.56
*18	155.5	51,620	332				155.5	1,137.21	7.31
*19	328.7	59,817	182				328.7	1,581.31	4.81
20	305.7	69,617	228				305.7	1,574.79	5.15
21	847.0	148,383	175				847.0	1,992.37	2.35
*22	443.7	124,157	279	121.5	4,545	37.4	443.7	3,597.24	8.10
Total	6,747.4	1,428,635	211	484.3	17,960	37.0	6,747.4**	$29,511.46	$4.37

*Working units not complete.

**The acreage sprayed had Ribes bushes other than R. petiolare hand pulled. Hence it is a part of the acreage listed under hand pulling and the two should not be added.

C. Cost of Meals Served in the Eradication Camps.

TABLE NO. 5

COST OF MEALS

Camp No.	Cooks' Salary	Cost of Food	Transp. of Food	Total Subs. Cost	Number of Meals	Ave. Cost Per Meal
1	$ 524.77	$1,409.55	$ 343.07	$2,277.39	7,284	$ .31
2	332.77	684.62	263.07	1,280.46	2,980	.43
3	422.50	1,165.07	343.07	1,930.64	4,800	.40
4	366.00	1,089.02	343.07	1,798.09	4,570	.39
Total	$1,646.04	$4,348.26	$1,292.28	$7,286.58	19,634	$ .37

Camp 1's average low meal cost was due in part to the large number of employees at that camp.

It was deemed advisable, due to the increased cost of meals in the last few years, to pay careful attention to this point during the 1930 season. A careful check was made of all expenditures as to food stuffs used, transportation, cooking costs and number of meals, with gratifying results. The meal cost has decreased below former seasons with no appreciable change in meal quality..

D. Checking.

The system employed in former years of checking the areas worked by eradication crews has been changed slightly. At present the camp supervisors and crew foremen are responsible for satisfactory work being performed by crews under their supervision. These men go over the work before moving on to the next camp site to see if it is necessary to rework any areas and check with the idea in mind of ascertaining the thoroughness of a once-over eradication job.

In the future the personnel of the project, "Effectiveness of Control," will make a survey of the areas worked in 1930 and make a report on the effectiveness of work performed by the eradication forces.

CONCLUSION

Ribes are rapidly being eradicated from stream type on the Potlatch Timber Protective Association. It is not improbable under favorable working conditions that local control in stream type will be completed within the next two years on this Association. The rapid progress was due partially to large areas having few Ribes in stream type and to the supervisor's knowledge of Ribes conditions through information obtained by a preliminary eradication survey.

RECOMMENDATIONS

1. The continued use of the extended budget system of funds to be expended during any year, or portion of a year. This system has proven invaluable while in the field, with the cooperation of the fiscal department in forwarding copies of all vouchers not written in the field to the project supervisor,

2. The reworking of all chemically sprayed areas after the mopping up work is completed should be undertaken along with a program of complete eradication of Ribes on the hillsides.

3. Camp equipment should be standardized for the various sized camps.

SCOUTING FOR BLISTER RUST IN NORTHERN IDAHO, 1930

By
E. I. Joy
Junior Forester

INTRODUCTION

From 1927 to 1929 a study of the locations of blister rust infections in north Idaho showed that the disease was spread over the entire white pine region of the state. It was further determined that the greatest amount of infection was in the southern part of this area where Ribes petiolare occurs in greatest abundance. Scouting in 1930 was confined mainly to the southern one-third and the extreme northern portion of the region.

PURPOSE

The purpose of scouting is to determine the extent and intensity of the disease. A secondary objective is the development of a stream type Ribes distribution map for this region.

LOCATION OF WORK

The most intensive work done was on lands of the Priest Lake, Potlatch and Clearwater Timber Protective Associations and the Kaniksu and Clearwater National Forests. Other areas on which some work was done were the Coeur d'Alene Timber Protective Association and the St Joe National Forest.

ORGANIZATION

A. Spring Scouting

Because of the large infection center at Newman Lake, Washington it is believed that other centers exist within a few miles of this area. In an effort to locate pine infection in the vicinity of Mica Peak and Mt. Spokane two members of the permanent personnel scouted in these areas in April. No infection was located.

B. Summer and Fall Scouting

1. Personnel. Scouting was carried on in conjunction with "Infection Surveys" and "Effectiveness of Control Studies". In addition, scouting was done by members of other projects whenever they had the opportunity.

2. Division of time. During the summer, scouting was done by the men while establishing and checking the stream type study plots and making disease surveys of the large areas of infection on the Potlatch, Clearwater

and Coeur d'Alene Associations. In the fall, scouting crews were organized for intensive work on the Kaniksu, St. Joe and Clearwater National Forests and the Priest Lake and Clearwater Associations.

3. Methods of work. The work was confined to the stream type where Ribes and pines are usually found in good association. More attention was given to pine scouting in an effort to locate as many centers of pine infection as possible, these being of considerable importance in the organization of the control program.

4. Data. Data were taken on the association of hosts, abundance of each, the number examined and infected and the quantity of infection when found. Distribution of the pines, the Ribes by species and location of infections found were shown on a rough sketch map of the drainage.

RESULTS OF SCOUTING

A. General Summary

The results of scouting done during 1930 have been summarized and appear in Table No. 1. Table No. 2 gives a detailed account of infections found in 1930 while Table No. 3 is a summary of all pine infections found in Idaho to date.

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TABLE NO. 1

SUMMARY OF SCOUTING IN NORTHERN IDAHO, 1930

County	Number Inspection Points	Number Infection Points	Ribes														Pines	
			R. petiolare		R. triste		R. inerme		R. irriguum		R. viscos.		R. lacustre		Total			
			Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.
Boundary	4	0	0	0	0	0	0	0	0	0	0	0	870	0	870	0	355	0
Bonner	13	0	0	0	0	0	2,350	0	0	0	0	0	1,300	0	3,650	0	2,005	0
Kootenai	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500	0
Shoshone	16	12	7,116	17	250	5	285	0	170	0	450	0	196	0	8,467	22	1,564	101
Clearwater	37	18	13,223	22	0	0	335	0	0	0	15	0	271	1	13,844	23	8,250	134
Totals	73	30	20,339	39	250	5	2,970	0	170	0	465	0	2,637	1	26,831	45	12,674	235

TABLE NO. 2

SUMMARY OF INFECTIONS FOUND IN NORTHERN IDAHO, 1930

County	Location	Ribes: Species	Ribes: Examined	Ribes: Infected	Ribes: Per Cent Leaves Infected Per Infected Bush	Pines: Examined	Pines: Infected	Pines: Year of Origin of Infection
Shoshone	Merry Creek above junction of East Fork and North Fork near Clarkia, Coeur d'Alene Timber Protective Association, township 43 north, range 2 east, section 33	R. petiolare	3,000	50	?			
		R. triste	250	5	?			
		R. inerme	250	0				
		R. viscosissimum	25	0				
		R. lacustre	100	0		1,000	100	1927
	Mouth of Lucky Swede Creek on North Fork of St. Joe River, St. Joe National Forest, township 46 north, range 6 east, section 6	R. petiolare	700	1	10			
		R. inerme	10	0				
		R. lacustre	10	0		30	0	
	Loop Creek, tributary to Little North Fork St. Joe River 4½ miles from mouth, township 46 north, range 6 east, section 11	R. petiolare	700	1	10			
		R. lacustre	10	0		30	0	
	Loop Creek 4 miles from mouth, township 46 north, range 6 east, section 11	R. petiolare	700	1	50			
		R. inerme	10	0				
		R. lacustre	10	0		30	0	
	Loop Creek at mouth of Clear Creek, township 46 north, range 6 east, section 11	R. petiolare	600	1	10			
		R. lacustre	10	0		30	0	
	Loop Creek at junction of two forks Allen and Ward creeks, township 46 north, range 7 east, section 20	R. petiolare	600	1	10			
		R. inerme	10	0				
		R. lacustre	10	0		20	0	
	Loop Creek 5 miles from mouth, township 46 north, range 6 east, section 11	R. petiolare	700	1	20			
		R. lacustre	10	0		30	0	
	Tributary Bullion Creek, 5.4 miles from highway on road to Avery, township 47 north, range 6 east; northwest quarter section 28	R. petiolare	40	2	15			
		R. viscosissimum	40	0				
		R. lacustre	10	0		15	0	
	Bullion Creek 16 miles north of Avery at crossing near County Cabin, township 47 north, range 6 east, section 29	R. petiolare	8	1	50			
		R. viscosissimum	2	0		15	0	
	Hammond Creek 6 miles northeast of Avery near road crossing, township 46 north, range 5 east, sections 2[illegible] and 26	R. petiolare	36	6	40			
		R. viscosissimum	8	0				
		R. lacustre	4	0		100	1	1927
	Kyle Creek 7.5 miles north of Avery at road crossing, township 46 north, range 5 east, section 24	R. petiolare	6	1	5	5	0	
	Nine miles north of Avery on road along Little North Fork St. Joe River, township 46 north, range 6 east, section 7	R. petiolare	1	1	75	4	0	
Clearwater	Beaver Creek one mile from mouth in Clearwater National Forest, township 40 north, range 7 east, section 7	R. petiolare	20	2	100	10	4	1927
	Beaver Creek 1/2 mile above Clearwater Timber Company, Camp 1, Clearwater Timber Protective Association, township 40 north, range 6 east, section 26	R. petiolare	500	4	70	200	0	
	Beaver Creek 5 miles above Clearwater Timber Company, Camp 1, Clearwater Timber Protective Association, township 40 north, range 6 east, section 34	R. petiolare	2,200	2	50	300	0	
	Beaver Creek 1/4 to 3/4 mile above Clearwater Timber Company, Camp 9, Clearwater Timber Protective Association, township 39 north, range 5 east, section 12	R. petiolare	3,000	3	10	50	0	
	North Fork Reed's Creek 1/2 mile below Headquarters, Clearwater Timber Protective Association, township 38 north, range 5 east, section 15	R. petiolare	25	0		50	7	1927
	North Fork Reed's Creek 1¾ miles below Headquarters, Clearwater Timber Protective Association, township 38 north, range 5 east, section 16. (Pine infection found in 1929. All infected trees found were cut.)	R. petiolare	7	2	100			
		R. lacustre	1	1	100			
		Ribes eradicated 1929				20	3	1927
	Little Beaver Creek above Clearwater Timber Company, Camp 3, Clearwater Timber Protective Association, township 37 north, range 5 east, section 10	R. petiolare	500	2	4	30	0	
	Trail Creek above Clearwater Timber Company Camp 3, Clearwater Timber Protective Association, township 37 north, range 5 east, section 10	R. petiolare	500	3	25	200	0	
	Quartz Creek 3/10 mile above mouth, Clearwater Timber Protective Association, township 37 north, range 5 east, section 34	R. petiolare	25	1	20	50	0	
	Quartz Creek at Clearwater Timber Company, Camp 12, Clearwater Timber Protective Association, township 37 north, range 5 east, section 5	R. petiolare	**Ribes sprayed.** Heavy infection noted on dried leaves in vicinity.			350	26	1927
	Rhodes Creek 1/4 mile above old dredge, Clearwater Timber Protective Association, township 37 north, range 5 east, section 36	R. petiolare	10	1	5			
		R. lacustre	100	0		500	62	1923
	Orofino Creek 6 chains below old dredge, Clearwater Timber Protective Association, township 36 north, range 5 east, section 13	R. petiolare	500	0				
		R. viscosissimum	15	0				
		R. inerme	25	0				
		R. lacustre	25	0		300	13	1927
	Oro Grande Creek 8 miles from Bungalow Ranger Station, Clearwater National Forest, township 38 north, range 7 east, section 33	R. petiolare	1,000	1	0.1			
		R. inerme	200	0				
		R. lacustre	500	0		150	0	
	Johnson Creek, branch of Cameron Creek 1¾ to 2 miles above mouth. Near Elk River, Potlatch Timber Protective Association, township 40 north, range 2 east, section 19	Ribes eradicated				250	9	1927
	Shattuck Creek, branch of Cameron Creek, 1½ miles from mouth, Potlatch Timber Protective Association, township 40 north, range 2 east, section 28	Ribes eradicated				200	1	1927
	Cameron Creek 7.4 miles from Elk River along highway. Potlatch Timber Protective Association, township 40 north, range 2 east, section 31	Ribes eradicated				75	5	1927
	Cameron Creek at forks 8.4 miles from Elk River, Potlatch Timber Protective Association township 40 north, range 1 east, section 25	Ribes eradicated				20	4	1927
	East Fork Potlatch Creek near 1928 chemical eradication camp, Potlatch Timber Protective Association, township 41 north, range 2 east, section 30	R. petiolare	10	1	100			
		R. lacustre	10	1	2	20	0	

Annual Report 1930
E. L. Joy

TABLE NO. 3

SUMMARY OF PINE INFECTIONS IN IDAHO, 1930

County	Location	Year Located	Probable Year of Origin
Clearwater	Elk Creek - Deep Creek, near Elk River, P.T.P.A., T. 39 N., R. 2 E., Sec. 14	1929	*1923
	Long Meadow Creek near Elk River P.T.P.A., T. 39 N., R. 1 E., Sec. 14	1929	*1923
	Johnson Creek near Elk River, P.T.P.A., T. 40 N., R. 2 E., Sec. 19	1930	1927
	Shattuck Creek near Elk River, P.T.P.A. T. 40 N., R. 2 E., Sec. 28	1930	1927
	Cameron Creek 7.4 miles from Elk River, P.T.P.A., T. 40 N., R. 2 E., Sec. 31	1930	1927
	Cameron Creek 8.4 miles from Elk River, P.T.P.A., T. 40 N., R. 1 E., Sec. 25	1930	1927
	North Fork of Reed's Creek 1½ miles below Headquarters, C.T.P.A., T. 38 N., R. 5 E., Sec. 16	1929	1927
	North Fork Reed's Creek ½ mile below Headquarters, C.T.P.A., T. 38 N., R. 5 E., Sec. 15	1930	1927
	Quartz Creek at Clearwater Timber Co., Camp 12, C.T.P.A., T. 37 N., R. 5 E., Sec. 5	1930	1927
	Rhodes Creek near Pierce, C.T.P.A., T. 37 N., R. 5 E., Sec. 36	1930	*1923
	Orofino Creek near Pierce, C.T.P.A., T. 36 N., R. 5 E., Sec. 13	1930	1928
	Beaver Creek, 1 mile from mouth, Clearwater National Forest, T. 40 N., R. 7 E., Sec. 7	1930	1927
Shoshone	Hammond Creek 6 miles northeast of Avery, St. Joe National Forest, T. 46 N., R. 5 E., Sec. 25, 26	1930	1927
	Middle Fork St. Maries River near Clarkia, Coeur d'Alene T.P.A., T. 42 N., R. 2 E., Sec. 5, 8-12	1929	*1923
	Merry Creek near Clarkia, T. 43 N., R. 2 E., Sec. 33	1930	1927

*Oldest known infections in Idaho.

B. Details of Pine Infection Centers

Eleven new pine infection centers were found in 1930. A detailed report of each follows:

1. Name - Johnson Creek infection.

Location - Near Elk River, Idaho $1\frac{3}{4}$ to 2 miles above junction with Cameron Creek.

Inspectors - E. Joy, R. Myers, C. Chapman - June 27, 1930.

Pine inspection - Abundant pine reproduction 1 to 20 years old is growing on logged land. 250 trees were examined, 9 of which were found infected with a total of 16 cankers. The 4 oldest cankers were fruiting for the first time indicating the center to be of 1927 origin. All cankers located were destroyed.

Ribes inspection - The Ribes were eradicated from this area in 1930. R. petiolare and R. inerme were quite abundant before eradication.

Remarks: This center is probably the result of the spread of aeciospores from the Long Meadow Creek infection which is about 5 miles distant.

2. Name - Shattuck Creek infection.

Location - Near Elk River, Idaho, $1\frac{1}{2}$ miles above junction with Cameron Creek.

Inspectors - E. Joy, C. Chapman, August 21, 1930.

Pine inspection - Scattered pine reproduction 1 to 20 years old is growing on logged land. Of a total of 200 trees examined only one was found infected. This tree had on it one canker which probably started in 1927. This canker was destroyed.

Ribes inspection - The Ribes were eradicated from this area in 1930. R. petiolare and R. inerme were abundant at that time.

Remarks: Although an intensive search was made only one canker could be found. As this point is approximately 6 miles airline from the Long Meadow Creek infection, it is probable that the latter is the source of the infecting spores.

3. Name - Cameron Creek infection (lower).

Location - 7.4 miles from Elk River along the highway.

Inspectors - C. Chapman, E. Joy, R. Myers, I. Nelson, June 21 and August 20, 1930.

Pine inspection - The stream and meadow type is wide at this point and supports only scattered white pine 1 to 40 years old. Excellent stands occur on either slope. 75 trees were examined in this vicinity. A total of 5 cankers were found on the 3 infected trees located. This center is probably of 1927 origin.

Ribes inspection - The Ribes were eradicated from this drainage in 1930. R. petiolare was the most abundant species.

Remarks: The Long Meadow Creek infection which is only 4 miles from this point is probably the source of the spores causing this center. The cankers located indicate that 1927 was the year this center started. All cankers found were destroyed.

4. Name - Cameron Creek infection (upper).

Location - 8.4 miles from Elk River along highway at forks of creek.

Inspectors - C. Chapman, E. Joy, R. Myers, June 23, 27, 1930.

Pine inspection - There is a scattering of young pine 21 to 40 years old at this point; of the 20 examined 4 were found infected with a total of 8 cankers which were destroyed.

Ribes inspection - The Ribes were eradicated from this drainage in 1930. In the vicinity of this infection R. petiolare was abundant.

Remarks: This infection center, like the three preceding is only a short distance from the Long Meadow Creek infection and probably was started in 1927 by aeciospores blown from that area.

5. Name - Beaver Creek infection.

Location - One mile from the mouth of the North Fork of the Clearwater River just inside the Clearwater National Forest.

Inspectors - H. G. Taylor, Clearwater Timber Company, reported infection on Ribes. E. Joy, F. Lane, September 3, 1930.

3. Name - Cameron Creek Infection (Lower).

Location - 7.4 miles from Elk River along the highway.

Inspectors - C. Chapman, E. Joy, L. Scott, L. Nelson, June 11 and August 24, 1932.

Pine Inspection - The stream and meadow type is wide at this point and supports only scattered white pine 1 to 40 years old. Excellent stands occur on either slope. 75 trees were examined in this vicinity. A total of 4 cankers were found on the 3 infected trees located. This center is probably of 1927 origin.

Ribes Inspection - The Ribes were eradicated from this drainage in 1930. R. petiolare was the most abundant species.

Remarks: The Long Meadow Creek infection which is only 4 miles from this point is probably the source of the spores causing this center. The cankers located indicate that 1927 was the year this center started. All cankers found were destroyed.

4. Name - Cameron Creek Infection (Upper).

Location - 8.4 miles from Elk River along highway at forks of creek.

Inspectors - C. Chapman, E. Joy, L. Scott, June 24, 25, 1932.

Pine Inspection - There is a scattering of young pine 11 to 40 years old at this point; of the 30 examined 4 were found infected with a total of 8 cankers which were destroyed.

Ribes Inspection - The Ribes were eradicated from this drainage in 1930. In the vicinity of this infection R. petiolare was abundant.

Remarks: This infection center, like the three preceding is only a short distance from the Long Meadow Creek infection and probably was started in 1927 by aeciospores blown from that area.

5. Name - Beaver Creek Infection.

Location - One mile from the mouth of the north fork of the Clearwater River just inside the Clearwater National Forest.

Inspectors - H. R. Taylor, Clearwater Timber Company, inspected infection on Ribes. E. Joy, J. Lowe, September 2, 1931.

Pine inspection - An excellent stand of mature timber grows to the edge of the stream type. A few suppressed trees 21 to 40 years old were found in the stream type. Several of these had been cut by the surveyors during the construction of a flume. Ten trees were examined and four of these found to be infected with a total of 39 cankers. The infected trees were destroyed.

Ribes inspection - R. petiolare and R. lacustre grow in scattered patches on this part of Beaver Creek. Immediately adjacent to the infected trees were two R. petiolare bushes with 100 per cent of the leaves infected. Other bushes a short distance away were not infected.

Remarks: Because of the presence of several cankers on 1924-26 growth that had fruited more than once, this infection appears to have originated before 1927. The complete analysis of cankers indicates the possibility of infection having originated in 1925 or 1926. All infected trees found were destroyed.

6. Name - North Fork Reed's Creek infection (upper).

Location - 1/2 mile below Headquarters, Idaho.

Inspectors - E. Joy, R. Myers, September 12, 1930.

Pine inspection - The Clearwater Timber Company has logged on this area leaving a good stand of pole-size timber. A few suppressed trees 21 to 40 years old were found in the stream type. 50 trees were examined, of which 7 were found to be infected with a total of 34 cankers.

Ribes inspection - The Ribes were eradicated from this drainage in 1929. An abundance of large R. petiolare and R. lacustre seedlings was found along the railroad grade and in a swampy seep on the west slope. No infected bushes were found.

Remarks: Heavy Ribes infection was found at this point in 1928. The canker analysis shows this center to be of 1927 origin.

7. Name: Quartz Creek infection.

Location: At Clearwater Timber Company Camp 12.

Inspectors: Ribes infection found by F. Heinrich. Pine infection found by C. Strong in the party with S. B. Detwiler and G. B. Posey August 28, 1930. Intensively scouted by K. Lane and L. Nelson August 29, 1930.

Pine Inspection - An excellent stand of [illegible] the edge of the stream type. A few suppressed trees 21 to 40 years old were found in the stream type. Several of these had been cut by the surveyors during the construction of a flume. Ten trees were examined and four of these found to be infected with a total of 35 cankers. The infected trees were destroyed.

Ribes Inspection - R. petiolare and R. lacustre grow in scattered patches in this part of [illegible] Creek. Immediately adjacent to the infected trees were two R. petiolare bushes with 100 per cent of the leaves infected. Other bushes a short distance away were not infected.

Remarks: Because of the presence of several cankers on [illegible] trees that had [illegible], this infection appears to have originated before 1927. The complete analysis of cankers indicates the possibility of infection having originated in 1925 or 1926. All infected trees found were destroyed.

6. Name - [illegible] Creek Infection [illegible].

Location - 1/2 mile above Headquarters, Idaho.

Inspectors - [illegible], September [illegible], 1930.

Pine Inspection - The Clearwater Timber Company has logged on this area leaving a good stand of pole-size timber. A few suppressed trees 21 to 40 years old were found in the stream type. 30 trees were examined, of which 3 were found to be infected with a total of [illegible] cankers.

Ribes Inspection - The Ribes were eradicated from this drainage in 1929. An abundance of large R. petiolare and R. lacustre seedlings was found along the railroad grade and in a swampy type on the east slope. No infected bushes were found.

Remarks: Heavy Ribes infection was found at this point in 1929. The canker analysis shows this center to be of 1927 origin.

7. Name: [illegible] Creek Infection.

Location: [illegible] Clearwater Timber Company Camp [illegible].

Inspectors: Ribes infection found by F. Heinrich. Pine infection found by [illegible] in the party with [illegible] August 28, 1930. Tentatively examined by [illegible] August 29, 1930.

Pine inspection - Young pines 21 to 40 years old are abundant in the stream type and at the edge of the mature timber. The original data taken were lost. It is estimated that 350 trees were examined, 26 of which were found to be infected. The total number of cankers is approximately 31.

Ribes inspection - The Ribes in this drainage were eradicated in 1930. Heavy infection on R. petiolare was found by F. Heinrich, Ribes eradication camp boss, at the time the bushes were being sprayed. Other infected bushes were found in this vicinity after examination of the dried leaves.

Remarks: This infection is probably of 1927 origin. No fruiting cankers were found here but heavy infection of the Ribes indicates that some are in the vicinity. All cankers found were destroyed.

8. Name - Rhodes Creek infection.

Location - 1/4 mile above old gold dredge and new sawmill near Pierce, Idaho.

Inspectors - E. Joy, R. Myers, K. Lane, L. Nelson September 5, 1930.

Pine inspection - White pines 21 to 40 years old are abundant at this point. 500 trees were examined, 62 of which were infected with 179 cankers. All infected pines were cut out.

Ribes inspection - Ribes infection was found in this locality both in 1928 and 1929 but no infected pines could be located. A very small amount of infection was found on the Ribes in 1930. There is a large amount of R. petiolare along the stream near this infection, and some R. lacustre. R. viscosissimum is found scattered on the slopes.

Remarks: After the discovery of one old canker on 1922 growth it was determined that this infection started in 1923. All other cankers were formed in 1926, 1927 or 1928.

9. Name - Orofino Creek infection.

Location - 6 chains below old dredge, near Pierce, Idaho.

Inspectors - K. Lane, E. Joy September 9, 1930.

Pine inspection - White pine reproduction 1 to 20 years old grows in abundance on the rocky dredge tailings in this drainage. 300 trees were inspected, 13 of which were infected.

The 18 cankers found were all destroyed.

Ribes inspection - R. petiolare is found in patches along the creek and swampy places near the edge of the dredge worked strip and scattered R. viscosissimum and R. lacustre grow on the undisturbed soil outside this strip. Infection was found in 1928 on R. petiolare in the area where the infected pines were located. Many of the infected trees were in close association with R. viscosissimum and R. lacustre indicating the probability that these species caused some of the infection.

Remarks: Analysis of the cankers found shows that this infection was started in 1928, the year infection was found on Ribes at this point. This is one of several instances where pine infection has been found by using the Ribes infection as a lead.

10. Name - Hammond Creek infection.

Location - 6 miles northeast of Avery at road crossing of Hammond Creek.

Inspectors - H. Putnam, C. Chapman, September 12, 1930.

Pine inspection - The pines in this vicinity, 11 to 20 years old, form part of a Forest Service plantation. Only one tree of 100 examined was found infected. The lone canker discovered, in the juvenile stage on 1926 growth, coupled with abundant infection on near-by Ribes, indicates the existence of a center of infection which originated in 1927 or earlier.

Ribes inspection - Several infected bushes of R. petiolare were found both up stream and down stream from the infected pine. R. viscosissimum and R. lacustre examined were not infected.

Remarks: This infection marks the location of the disease for the first time in the St. Joe National Forest. It is planned to do a large amount of scouting on this forest in 1931.

11. Name - Merry Creek infection.

Location - Immediately above the junction of the East and North Forks, near Clarkia.

Inspectors - F. Staat, R. Myers, C. Chapman, July 1, 1930.

Pine inspection - In this drainage there is a very heavy stand of thrifty white pine 41 to 60 years old. It is estimated that 1,000

trees were examined and 100 found to be infected. No records were kept of the intensive work done in this drainage by various members of the personnel.

Meager reports available indicate that this infection is of 1927 origin.

Ribes inspection - In this drainage occur five species of Ribes, namely, R. *petiolare*, R. *triste*, R. *inerme*, R. *viscosissimum* and R. *lacustre*. A considerable amount of infection was seen on R. *petiolare* and R. *triste* but none was found on the last three species named.

Remarks: The Merry Creek infection is approximately two miles from the St. Maries River infection which, in all probability is the source of aeciospores causing many small centers in this vicinity.

Table No. 4 which follows shows the pine infection intensity and the accompanying Ribes conditions on these 11 areas.

TABLE NO. 4

RIBES ABUNDANCE AND PINE CANKERS AT INFECTION CENTERS

Area	Ribes Abundance: Light, Medium, Heavy					Cankers Originating	
	R.pet.	R.triste	R.iner.	R. vis.	R. lac.	In 1923	Since 1923
Johnson Creek *	M	O	M	O	L	O	16
Shattuck Creek *	M	O	M	O	L	O	1
Cameron Creek (lower)*	M	O	L	O	L	O	5
Cameron Creek (upper)*	M	O	O	O	L	O	8
Beaver Creek	L	O	O	O	L	O	39
North Fork Reed's Creek (Upper)**	M	O	O	O	L	O	34
Quartz Creek *	H	O	O	O	L	O	21
Rhodes Creek	M	O	O	L	L	1	178
Orofino Creek	L	O	O	L	L	O	18
Hammond Creek	M	O	O	M	M	O	1
Merry Creek	H	L	L	L	L	O	125 (Est.)

*Ribes eradicated in 19[illegible].
**Ribes eradicated in 1929.

DISCUSSION

The Idaho scouting work in 1930 was done in the drainages of 58 streams. In 38 of these no infection was found. Of the 20 drainages in which infection was found 4 had pine infection only, 10 had Ribes infection only, and 6 had infection on both hosts.

As in the past two years, most of the infection found in 1930 was in the southern part of the white pine region where R. petiolare grows in abundance. It is important to note that of the 15 pine infections found in this southern part, 4 originated in 1923 and 11 since that date. Because only a small per cent of the total area is scouted and it is much easier to locate the large centers of 1923 origin, it is probable that the number of infection centers started since 1923 is 10 times the number of 1923 centers in existence instead of 2-3/4 times as shown above.

COSTS

The following is a summary of the costs for scouting in Idaho in 1930.

Salaries	$819.66
Expenses	347.80
Total	$ 1,167.46

CONCLUSION

Scouting in Idaho for the last two years has been done mostly in the southern part of the white pine belt. In 1931 an intensive program of scouting should be planned for the northern two-thirds of this belt in order to get a more complete picture of infection conditions in this region. In the future more emphasis should be given scouting for blister rust in the upland types because it is here that many of the close host plant associations are to be found. Also, it is only recently that it has been forcibly brought to our attention by the Long Meadow Creek infection that the upland species of Ribes are extremely important in the intensification of the disease.

BLISTER RUST CONTROL WORK IN WASHINGTON

1930

[illegible]

Blister rust control activities in Washington were continued as a cooperative project between the Bureau of Plant Industry and the Washington State Department of Agriculture. There is given below the amendment to the basic memorandum of understanding, which was drawn up to cover the cooperative work for the fiscal year 1931 beginning July 1, 1930:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1,1927

Between

THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY

and the

WASHINGTON STATE DEPARTMENT OF AGRICULTURE.

Cooperative Work in Controlling White-Pine Blister Rust in
WASHINGTON

Paragraph C-6 of the Memorandum of Understanding described above contains the following:

> "For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $13,000 to the support of this cooperative work, and the Washington State Department of Agriculture shall contribute in value approximately $8,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1931 there will be contributed in value by the Washington State Department of Agriculture approximately $8,000.00, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister-Rust Control approximately $7,700.00 in connection with cooperative blister-rust-control work in Washington.

Date:		Signature:
6-3-30	(s)	Erle J. Barnes Director, Washington State Department of Agriculture.
June 19, 1930	(s)	Wm. A. Taylor Chief, Bureau of Plant Industry.

BLISTER RUST CONTROL WORK IN WASHINGTON
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and the
WASHINGTON STATE DEPARTMENT OF AGRICULTURE.

Cooperative work in Controlling White-Pine Blister Rust in WASHINGTON

* * *

Paragraph C-2 of the Memorandum of Understanding described above contains the following:

"For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $16,000 to the support of this cooperative work, and the Washington State Department of Agriculture shall contribute in value approximately $6,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1931 there will be contributed in value by the Washington State Department of Agriculture approximately $8,000.00, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister-Rust Control approximately $7,700.00 in connection with cooperative blister-rust-control work in Washington.

Date:	Signature:
6-3-30	(s) Erle J. Barnes Director, Washington State Department of Agriculture.
June 19, 1930	(s) Wm. A. Taylor Chief, Bureau of Plant Industry.

RIBES ERADICATION MOUNT RAINIER NATIONAL PARK

By
M. C. Riley
Junior Forester

INTRODUCTION

White pine blister rust was found on Ribes in the general vicinity of Mount Rainier National Park in 1927 on Big Creek at the Rainier National Forest boundary. Blister rust was first found within the Park boundary in 1928 when it was seen on Ribes along the Nisqually River below Longmire. Pine infection was first found in the spring of 1930 on Fish Creek along the West Side Highway at a point about two and one-half miles north of the Longmire Highway.

In the fall of 1933, at the request of the Park Service, Department of the Interior, officials of the Office of Blister Rust Control examined certain designated areas containing white pine and gave their technical recommendations regarding the feasibility of initiating blister rust control and the probable cost of the work.

The work of actual Ribes eradication covered by this report was financed by the Park Service. Personnel of the Office of Blister Rust Control supervised the work.

PURPOSE OF WORK

The purpose of the work was to complete the eradication of Ribes over a sufficient area to insure protection of the designated white pine stands on the basis of what is now known regarding the width of protection zone necessary.

LOCATION AND DESCRIPTION OF THE AREA

The areas designated to be protected are generally known as Longmire and the Silver Forest. The Longmire area centers around Park Headquarters and consists of a rather extensive area on which white pine constitutes a valuable part of the timber stand. This area was deemed important, because a majority of the people now visiting the Park enter through the Nisqually Valley and pass through Longmire.

The Silver Forest area is located about two miles by air line northeast of Longmire. This is a burn which supports a fine stand of young white pine and through which passes the highway to Paradise Valley.

Because of the fact that the two main areas mentioned above are only two miles apart it was necessary to work all of the stream type between them.

[illegible] ERADICATION MOUNT RAINIER NATIONAL PARK

By

M. O. Riley

Junior Forester

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White pine blister rust was found on Ribes in the general vicinity of Mount Rainier National Park in 1927 on Big Creek at the Rainier National Forest boundary. Blister rust was first found within the Park boundary in 1928 when it was seen on Ribes along the Nisqually River below Longmire. Pine infection was first found in the spring of 1930 on Fish Creek along the West Side Highway at a point about two and one-half miles north of the Longmire Highway.

In the fall of 1935, at the request of the Park Service, Department of the Interior, officials of the office of Blister Rust Control examined certain designated areas containing white pine and gave their technical recommendations regarding the feasibility of installing blister rust control and the probable cost of the work.

The work of actual Ribes eradication covered by this report was financed by the Park Service. Personnel of the Office of Blister Rust Control supervised the work.

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LOCATION AND DESCRIPTION OF THE AREA

The areas designated to be protected are generally known as Longmire and the Silver Forest. The Longmire area centers around Park Headquarters and consists of a rather extensive area on which white pine constitutes a valuable part of the timber stand. This area was deemed important, because a majority of the people now visiting the Park enter through the Nisqually Valley and pass through Longmire.

The Silver Forest area is located about two miles by air line northeast of Longmire. This is a burn which supports a fine stand of young white pine and through which passes the highway to Paradise Valley.

Because of the fact that the two main areas mentioned were only two miles apart it was necessary to work all of the stream line between them.

All of the area supporting Ribes was worked along the Nisqually River from a point one mile below Longmire to the Nisqually Glacier. The tributaries of the Nisqually were completed for a sufficient distance to insure protection of the pine stands. Paradise Creek was worked from its mouth to Narada Falls. The tributaries of Paradise Creek were also covered with the exception of Tatoosh Creek. All of the area from which Ribes were eradicated was classed as stream type. Generally speaking, the timber stands are so dense that they have practically no Ribes.

Ribes bracteosum, R. lacustre and R. laxiflorum are generally distributed over the area. Nisqually River and Paradise Creek have their origin in glaciers of the same names. Due to melting of the glaciers in the summer season, water rises during the day and recedes at night, and the continuous depositing of silt on the low flats bordering the stream beds made eradication extremely difficult in many instances.

METHODS, EQUIPMENT AND MATERIALS

The prime motive governing the work on Mount Rainier National Park was the preservation of natural beauty, and in view of this it was not deemed advisable to use toxic sprays, the application of which would have been the cheapest method of destroying many dense masses of susceptible currants and gooseberries. The hand pulling method of Ribes eradication was used entirely. It consisted of covering the ground with three-man crews with the foremen working in line.

All men were furnished quarters and subsistence at the Park Service camp at Longmire during the entire season. Transportation when needed was furnished by the Park Service.

The necessary twine was furnished by the Office of Blister Rust Control, as were some of the special California Ribes tools which proved to be more satisfactory than any other type tried. Other tools and equipment were furnished by the Park Service.

Maps of the area covered by this report are on file in the Spokane and Washington offices.

RESULTS OF WORK

The results of the work on Mount Rainier National Park during the 1930 field season are tabulated as follows:

All of the area supporting Ribes was worked along the Nisqually River from a point one mile below Longmire to the Nisqually Glacier. The tributaries of the Nisqually were completed for a sufficient distance to insure protection of the pine stands. Paradise Creek was worked from its mouth to Narada Falls. The tributaries of Paradise Creek were also covered with the exception of Faloch Creek. All of the area from which Ribes were eradicated was classed as stream type. Generally speaking, the timber stands are so dense that they have practically no Ribes.

Ribes bracteosum, R. lacustre and R. laxiflorum are generally distributed over the area. Nisqually River and Paradise Creek have their origin in glaciers of the same names. Due to melting of the glaciers in the summer season, water rises during the day and recedes at night, and the continuous depositing of silt on the low flats bordering the stream beds made eradication extremely difficult in many instances.

METHODS, EQUIPMENT AND MATERIALS

The prime motive governing the work on Mount Rainier National Park was the preservation of natural beauty, and in view of this it was not deemed advisable to use triki spraying, the application of which would have been the cheapest method of destroying many dense masses of susceptible currants and gooseberries. The hand pulling method of Ribes eradication was used entirely. It consisted of covering the ground with three-man crews with the foreman working in line.

All men were furnished quarters and subsistence at the park service camp at Longmire during the entire season. Transportation when needed was furnished by the park service.

The necessary maps was furnished by the office of Blister Rust Control, as were some of the special California Ribes tools which proved to be more satisfactory than any other type tried. Other tools and equipment were furnished by the Park Service.

Maps of the area covered by this report are on file in the Spokane and Washington offices.

RESULTS OF WORK

The results of the work on Mount Rainier National Park during the 1933 field season are tabulated as follows:

TABLE NO. 1

SUMMARY OF RESULTS OF RIBES ERADICATION, MOUNT RAINIER NATIONAL PARK, 1930

Eradication Class	Man-Days				Number Ribes Pulled						Acres Per Man Day
	Crewman	Foreman	Total	Acres	R. lac.	R. brac.	R. lax.	R. acer.	R. sang.	Total Ribes	
B	40.9	20.8	61.7	154.5	7,858	2,414	1,718	61	8	12,059	2.50
C	258.6	130.7	389.3	294.4	75,849	34,847	18,069	1,812	-	130,577	.76
D	251.5	126.7	378.2	85.6	60,050	31,597	22,731	777	8	115,163	.23
M	128.0	54.8	182.8	24.9	29,781	17,790	11,220	163	-	58,954	.14
Totals or Averages	679.0	333.0	1,012.0	559.4	173,538	86,648	53,738	2,813	16	316,753	.55

TABLE NO. 2

AVERAGE NUMBER OF RIBES PER ACRE MOUNT RAINIER NATIONAL PARK, 1930

Class	Acres Worked	Number Ribes Per Acre					
		R. lac.	R. brac.	R. lax.	R. acer.	R. sang.	Total
B	154.5	50.9	15.6	11.1	.4	.1	78.1
C	294.4	257.6	118.4	61.4	6.2	-	443.6
D	85.6	701.5	369.1	265.5	9.0	.1	1,345.2
M	24.9	1,196.0	714.5	450.6	6.5	-	2,367.6
Totals or Averages	559.4	310.2	154.9	96.1	5.0	-	566.2

TABLE NO. 3

COST OF OPERATION

Item	Amount
Salaries:	
Supervision	$833.32
Temporary men	5,132.47
Transportation of men	105.20
General equipment:	
Cost	10.81
Transportation	10.00
Miscellaneous:	
Twine	28.80
Expenses	195.97
Total	$6,316.57

TABLE NO. 4

COST OF ERADICATION

Eradication Class	Total Man-Days	Acres	Cost Per Acre
B	51.7	154.5	$2.49
C	389.3	294.4	8.25
D	373.2	85.6	27.57
M	187.8	24.9	45.61
Totals or Averages	1,012.0	559.4	$11.29

Table No. 3 includes all funds expended for Ribes eradication both by the Park Service and the Office of Blister Rust Control. The cost per man-day including supervision was $6.24. The cost per man-day on the basis of Park Service expenditure alone was $5.18. The Office of Blister Rust Control expended $1,068.09. The Department of the Interior expended $5,248.48.

A report has been submitted covering the preliminary Ribes eradication survey of certain white pine areas on Mount Rainier National Park. The cost of this survey was borne by the Bureau of Plant Industry.

PRELIMINARY RIBES ERADICATION SURVEY
Mount Rainier National Park

Introduction

During the course of the 1930 field season the representatives of the Office of Blister Rust Control were requested by officials of the Park Service to examine other areas in the park containing white pine and to give their technical recommendations regarding the practicability of and the estimated cost of applying local control measures. The areas designated by the Park Service were examined and a report was given to the Park Service immediately upon completion of the work. No attempt was made to weigh the value of the white pine against the cost of protection so far as relative importance of the various areas was concerned.

Location and Description of the Areas

Four of the areas examined were on the south side of the park and two were on the north side. All of the areas contained much stream type and all except one contained Ribes outside of the stream type.

The Emerald Ridge, Longmire-Silver Forest, Rampart Ridge and White River-Yakima Park areas are all on scenic roads, and the Mowich River and Muddy Fork of Cowlitz areas are situated on proposed roads. This fact makes all of the areas important because the main objectives of national parks are the preservation of natural beauty and an increased public enjoyment of recreational values.

All of the areas contain _P. monticola_, and the White River-Yakima Park area also contains a considerable amount of _P. albicaulis_. _R. bracteosum_, _R. laxiflorum_ and _R. lacustre_ are common on all of the areas and _R. acerifolium_ and _R. divaricatum_ occur on the White River-Yakima Park area.

Procedure and Methods

The preliminary survey of stream type was based on the cost per acre according to comparable areas previously worked. All streams were examined intensively and a rough map was made showing the width and length of the stream type according to the per acre cost. Strips were run through the upland types sufficiently close together to give an accurate picture of the area. No attempt was made to list any of the areas by eradication classes.

Results of Work

The following table gives the results of the preliminary Ribes eradication survey:

TABLE NO. 1

RESULTS OF PRELIMINARY RIBES ERADICATION SURVEY

Area	Acres to be worked	Acres to be Protected	Age of White Pine	Estimated Protection Cost	No. Men Required For Season
Emerald Ridge	2,625	900	20-40 200+	$ 7,065.00	21
Longmire-Silver Forest	2,900	1,950	20-40 200+	1,700.00	20*
Lowich River	515	110	100-200	2,300.00	12
Muddy Fork Cowlitz	2,900	1,350	20-40	5,600.00	17
Rampart Ridge	2,820	1,025	30-40	4,800.00	10*
White River-Yakima Park	5,000	2,310	60-80	3,400.00	11
Totals	16,860	7,645	-	$25,515.00	-

* Both areas to be worked by same crew during one season.

The estimated protection cost for the Longmire-Silver Forest area represents the work to be done in order to carry out the contemplated extension of the area, while the acreage figures represent the entire area including the acreage worked during the 1930 field season.

The cost estimates given in the above table are for eradication only and do not include charges for such items as equipment, packing, trail construction, etc. The acreage to be protected is less than the acreage to be worked due to the fact that the latter figure includes a protective zone around the actual pine area and that it is also necessary to work the stream type for a considerable distance outside the pine area due to the presence of R. bracteosum on all of the streams.

In connection with the areas listed above, two other bodies of white pine were examined, but neither area would apparently warrant the necessary protection cost due to the scattered white pine and extensive dense concentrations of Ribes.

SCOUTING FOR BLISTER RUST IN WASHINGTON - 1930

By

E. L. Joy

Junior Forester

INTRODUCTION

Because of the known abundance of blister rust in the western part of the state and the small amount of white pine in the eastern part, very little scouting was done in Washington in 1930. There are a few important areas such as the Wind River Nursery and Mount Rainier National Park where some scouting is necessary in connection with the protection work being done.

PURPOSE

The purpose of scouting is to determine the extent and intensity of the disease.

LOCATION OF WORK

A small amount of work was done in the northeastern part of the state in conjunction with the north Idaho work. Other areas in the state where scouting was done are the Mount Rainier National Park and the vicinity of the Wind River Nursery.

PERSONNEL

The work in northeastern Washington was done by a crew of temporary men. In Mount Rainier National Park and at the Wind River Nursery scouting was done by members of both the permanent and temporary personnel of the office in conjunction with other work being performed on these areas.

RESULTS

A. Northeastern Washington

The disease was not found in the northeastern part of the state. The small amount of scouting done resulted in the examination of the following:

R. inerme - 550 bushes.
R. viscosissimum - 300 bushes.
R. lacustre - 260 bushes.
White pine - 1,275 trees.

[illegible]

by

[illegible]

Junior Forester

INTRODUCTION

[illegible] rust in the western part of the state and the small amount of white pine in the eastern part, very little scouting was done in [illegible]. There are a few important areas such as the [illegible] Nursery and [illegible] National Park where some scouting is necessary in connection with the protection work being done.

PURPOSE

The purpose of scouting is to determine the extent and intensity of the disease.

LOCATION OF WORK

A small amount of work was done in the [illegible] part of the state in conjunction with the [illegible] work. Other areas in the state where scouting was done are the [illegible] National Park and the vicinity of the [illegible] Nursery.

PERSONNEL

The work in [illegible] was done by a crew of temporary men. In [illegible] National Park and at the [illegible] Nursery scouting was done by members of both the permanent and temporary personnel of the office in conjunction with other work being performed on these areas.

RESULTS

1. [illegible]

The disease was not found in the [illegible] part of the state. The small amount of scouting done resulted in the examination of the following:

1. Ribes - [illegible] bushes.
2. [illegible] - [illegible] bushes.
3. [illegible] - [illegible] bushes.
4. White pine - [illegible] trees.

B. Mount Rainier National Park and Rainier National Forest

A large center of infection was found in Mount Rainier National Park near Longmire early in the season. Intensive scouting done later revealed a total of three centers in the southwest corner of the Park and one 3 miles outside the Park boundary. A summary of these infections follows:

1. Name: Fish Creek infection.

Location: In Mount Rainier National Park along Fish and [illegible] creeks and the West Side Highway, township 15 north, range 7 east, sections 23, 26 (unsurveyed).

Extent: 1-1/4 mile along Fish and [illegible] creeks and up the slope west of Fish Creek for 1/4 mile.

Pine inspection: White pines 41 to [illegible] years old are scattered throughout the drainage. In the vicinity of the main center of infection, which is on Fish Creek, the pines are heavily infected and much branch killing is evident. It is estimated that the most severely infected trees have as high as [illegible] cankers per tree. This infection probably entered here about [illegible].

Ribes inspection: R. bracteosum, R. laxiflorum and R. lacustre occur in abundance and are heavily infected near this center.

2. Name: Longmire infection.

Location: Just below Longmire, Washington, along the Nisqually River, township 15 north, range 8 east, section [illegible].

Pine inspection: Abundant young white pines were growing along the river at this point. Of the 47 trees examined, 10 were found infected with [illegible] cankers. Infection probably entered in [illegible] or earlier. All infected trees were destroyed.

Ribes inspection: R. bracteosum, R. laxiflorum and R. lacustre were found in medium abundance and not heavily infected. The Ribes were eradicated from this drainage in [illegible].

3. Name: Nisqually Glacier infection.

Location: 1/8 mile below the snout of Nisqually Glacier, township 15 north, range 8 east, section 16 (unsurveyed).

Pine inspection: Very few pines grow in this vicinity. Only one infected tree with one canker of [illegible] origin was found.

Ribes inspection: The Ribes were eradicated from this drainage. Before eradication, R. bracteosum, R. lacustre and R. laxiflorum were abundant.

4. Name: Lewis County Bridge infection.

Location: On both sides of the Rainier National Forest boundary at the township corner between township 14 and township 15 north, and range 6 and range 7 east, and for one mile east of this point along Big Creek.

Pine inspection: Young pines are quite abundant in this vicinity. Of the 250 examined, 8 were infected with a total of 12 cankers. This center probably originated in 1927.

Ribes inspection: In 1927 scattered infection was found on R. bracteosum, R. divaricatum and R. lacustre at this point. Only a very small amount of infection was found on the Ribes in this vicinity in 1930.

C. Wind River Nursery

A crew under the direction of the state leader of Oregon did a considerable amount of scouting in the vicinity of the Wind River Nursery. Three pine and three Ribes infection locations were found in this vicinity. A detailed report of these infections is presented in the following tables:

TABLE NO. 1

PINE INFECTIONS NEAR WIND RIVER NURSERY, WASHINGTON

County	Region	T.	R.	S.	Host	Number of Pines Exam.	Number of Pines Infected	Inspectors	Date	Remarks
Skamania	Hemlock	4N	6E	27	P. monticola	15	1	Goodding	8/14/30	On 1927 wood Fruited once
		4N	6E	28	P. monticola	25	1	Lyle and Wilson	8/22/30	On 1925 wood Fruited once
		4N	6E	28	P. monticola	50	3	Lyle and Wilson	8/22/30	9 cankers on 1925, 1926 and 1927 wood. Fruited once or twice.

No reference is made to infected Ribes in proximity to diseased pines.

TABLE NO. 2

RIBES INFECTIONS NEAR WIND RIVER NURSERY, WASHINGTON

County	Region	T.	R.	S.	Host	Number of Ribes Exam.	Number of Ribes Inf.	% Inf. Leaves	% Infected Surface Uredinia	% Infected Surface Telia	% Infected Surface Necrotic	Assoc.	Inspector	Date
Skamania	Rock Creek	3N	9E	14	R. bracteosum	50	2	25	0	75	25	Poor	Hinckley and Locke	8/22/30
		3N	9E	10	R. sanguineum	1	1	5	[illegible]	75	25	Poor	Hinckley and Locke	8/22/30
	Hemlock	2N	7E	3	R. bracteosum	10	1	1	0	75	25	Poor	Coleman	7/23/30

DISCUSSION

Although the disease is generally distributed throughout the Cascades of western Washington, the Mount Rainier National Park infections are of considerable importance since protection work was started there this year.

Further scouting should be done in Mount Rainier National Park in order to determine the amount of infection present, such information being necessary in planning the control work for this unit. Because of the inaccessibility of much of the area and the meager information available as to the distribution of white pine on the park, a thorough scouting of this unit would require much time.

Infections found in the vicinity of the Wind River Nursery are very important because of the nursery sanitation program under way. Much scouting in this vicinity is necessary in order to determine the amount of infection to which the protected area is being subjected.

COSTS

Inasmuch as the scouting done in Washington was incidental to other work, the costs were not segregated.

CONCLUSIONS

Since blister rust has been found in abundance throughout western Washington, there is very little need for any extensive scouting program in this region except where small areas of importance, such as the two mentioned in this report, are involved. It is important though, that the Colville National Forest and adjacent areas in northeastern Washington be scouted thoroughly in 1931 for the purpose of completing the picture of infection conditions in the Inland Empire.

BLISTER RUST CONTROL WORK IN OREGON

1930

Blister rust control activities in Oregon were continued as a cooperative project between the Bureau of Plant Industry and the Oregon State Board of Horticulture, Oregon State Board of Forestry, Oregon State College, School of Forestry and the Extension Service. There is given below the amendment to the basic memorandum of understanding, which was drawn up to cover the cooperative work for the fiscal year 1931 beginning July 1, 1930:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1,1927

Between

THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
OREGON STATE BOARD OF HORTICULTURE - - - OREGON STATE BOARD OF FORESTRY - - - and the OREGON STATE COLLEGE

Cooperative Work in Controlling White-Pine Blister Rust in
OREGON

* * *

Paragraph E-6 of the Memorandum of Understanding described above contains the following:

> "For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $16,000 to the support of the cooperative work, and the Oregon State Board of Horticulture approximately $14,250, the Oregon State Board of Forestry approximately $7,000, and the Oregon Agricultural College shall contribute in value approximately $1,500; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1931 there will be contributed in value by the Oregon State Board of Horticulture approximately $7,000, by the Oregon State Board of Forestry approximately $7,000, by the Botany Department of the Oregon State College approximately $1,000, by the School of Forestry of the Oregon State College approximately $250, by the Extension Service of the Oregon State College approximately

BLISTER RUST CONTROL WORK IN OREGON

1931

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AMENDMENT TO

MEMORANDUM OF UNDERSTANDING

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and the

OREGON STATE BOARD OF HORTICULTURE - - - OREGON STATE BOARD OF FORESTRY - - - and the OREGON STATE COLLEGE

Cooperative Work in Controlling White Pine Blister Rust

[illegible]

* * *

Paragraph E-5 of the Memorandum of Understanding governing these contains the following:

"For the fiscal year 1930, the Bureau of Plant Industry shall contribute in value approximately [illegible] to the support of the cooperative work, and the Oregon State Board of Horticulture approximately $14,200, the Oregon State Board of Forestry approximately $7,000, and the Oregon Agricultural College shall contribute in value approximately $1,500; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1931 there will be contributed in value by the Oregon State Board of Horticulture approximately $7,000, by the Oregon State Board of Forestry approximately [illegible], by the Botany Department of the Oregon State College approximately [illegible], by the School of Forestry of the Oregon State College approximately [illegible], by the Extension Service of the Oregon State College approximately

$500, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister-Rust Control, approximately $8,700.00, in connection with cooperative blister-rust-control work in Oregon.

Date:	Signature:
June 10, 1930	(s) T. A. Sammis, Jr. President, Oregon State Board of Horticulture
June 26, 1930	(s) Lynn F. Cronemiller State Forester, Oregon State Board of Forestry
June 2, 1930	(s) H. P. Barss Plant Pathologist, Oregon State College
June 6, 1930	(s) Geo. W. Peavy Dean, School of Forestry
June 23, 1930	(s) Paul V. Maris Director of Extension Service
July 9, 1930	(s) Wm. A. Taylor, Chief, Bureau of Plant Industry

BLISTER RUST CONTROL WORK IN OREGON, 1930

By

L. N. Goodding
Associate Pathologist

Blister rust work in Oregon during 1930 consisted largely in continuing work begun in 1929. For convenience, the nursery sanitation at Wind River, Washington is considered as a part of the Oregon work.

RIBES ERADICATION IN THE STILL CREEK AREA, 1930

Work was resumed in 1930 on clearing the Ribes from the Still Creek area. The nature of the territory worked and the lack of concentration of the blocks planted to pine have necessitated clearing Ribes from fully twice the area to be protected. Even with this wide margin, it is questionable whether full protection will be afforded. On the whole the project has been quite discouraging. The great amount of stream type, the difficulty of approach, the high cost of supplying provisions, the heavy concentration of Ribes, the apparent stubborn resistance of the species to chemicals, the complications due to beaver work, and the appearance of blister rust in several parts of the planting tend to make the contest stubborn and immediate. Looking backward, it is evident that some improvements could have been made in planning the work. A few more men last season could have cleared up everything except the Veda Lake area. As it stands, some further work is urgently necessary.

RECOMMENDATIONS FOR FUTURE WORK

It is obvious that the Still Creek region is not sanitary with respect to blister rust at present. Not all the stream type eradication area has been rechecked, and some places left for chemical work will have to be eradicated by hand if satisfactory chemical methods are not forthcoming by next spring. Veda Lake represents the worst of these. If it is to be worked by hand, a crew should establish a camp at the lake, as the time consumed in going to and from the lake from the old Still Creek planting cabin is much too great. Fortunately a good trail follows the ridge above the lake, and provisions can be packed in without great difficulty from Summit Meadows. A trail perhaps a half mile long leading from this main trail will need to be established. The ecology plots which have been left will need to be eradicated. These plots will require but little time, but some of the heavy concentrations of _Ribes lacustre_ on both slopes near the east end of the planting will require considerable time. Lund, who was camp boss at Still Creek this season, thinks that a crew of six will be required for most of the summer to clean up the Still Creek region decently if Veda Lake is included in the eradication. Mr. Posey thinks this is essential to the job. As we

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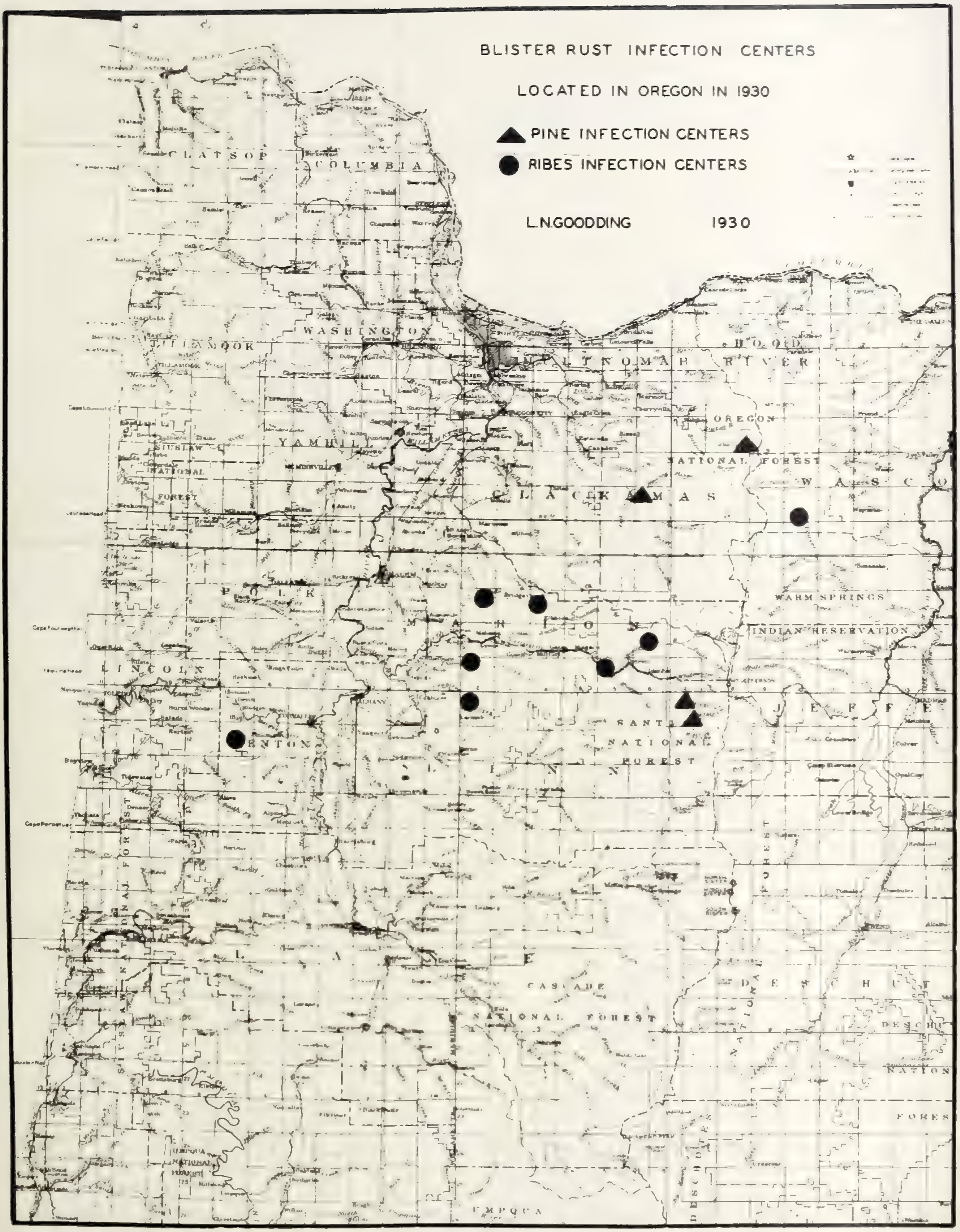


Annual Report 1930
L. N. Goodding

have put our hands to the plow, we had better not look back.

TABLE NO. 1

EXPENSES FOR STILL CREEK PROJECT, 1930

Item	Amount
Day labor (including cook)	$1,344.41
Salaries	641.01
Food supplies and materials	789.19
Equipment purchased, still on hand	63.14
Miscellaneous items	82.90
Transportation*	118.02
Total	$3,038.37

*Transportation is for use of personally owned cars at the rate of 7¢ per mile, and of Government owned truck at 4.62 cents per mile (the calculated rate of expense per mile for gas, oil and repairs and depreciation).

TABLE NO. 2

COSTS APPORTIONED TO TYPES

Type	Acres	Per acre	Total
New Eradication*			
Stream type	80	$31.83	$2,546.79
Old burn	424	.80	339.58
Re-check eradication			
All stream type	100	1.52	152.00
Totals	604	[illegible]	$3,038.37

*Estimating from checkers' records, 15/17 of the work on new eradication was devoted to stream type and 2/17 to old burn. The recheck required 35 man-days, at a cost of $152.00.

TABLE NO. 3

ERADICATION IN THE STILL CREEK AREA

Species	New Eradication				Re-check		Totals	
	Stream Type		Old Burn		Stream Type			
	Number	F.L.S.	Number	F.L.S.	Number	F.L.S.	Number	F.L.S.
R. lacustre	12,476	268,999	1,345	30,150	565	11,458	14,386	310,607
R. bracteosum	2,053	39,522	4	730	740	4,765	2,797	45,017
R. triste	46	520			22	68	68	588
R. sanguineum	47	1,854	8	813	1	25	56	2,692
R. viscosissimum	1	40	47	1,437			48	1,477
Totals	14,625	310,935	1,404	33,130	1,328	16,316	17,357	360,381

The new eradication is equivalent to 122.2 bushes per acre, with 3,886.7 feet of live stem for the stream type, and 5.31 bushes per acre with 78.13 feet of live stem per acre for the old burn type.

Re-check eradication was limited to stream type and is equivalent to 13.28 bushes per acre, with 163.16 feet of live stem per acre.

WIND RIVER NURSERY RIBES ERADICATION, 1930

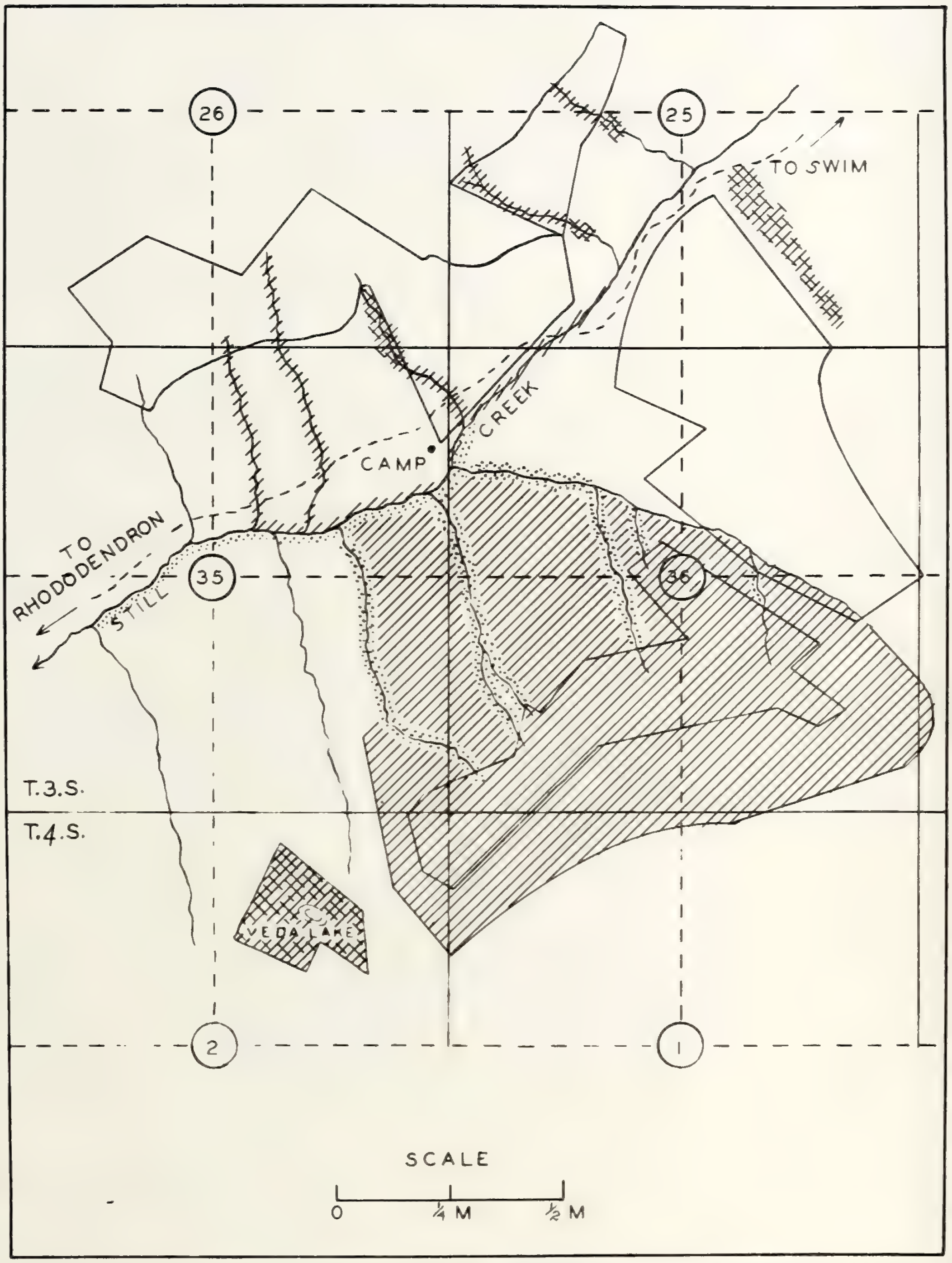
See 1928 and 1929 annual reports for work previously done on this project.

This year, a crew of six men began the work on June 16. Later the crew was reduced to five men. Work was continued until the 28th of August.

The extent of the 1930 Wind River Nursery Ribes eradication work was a complete re-check of all territory previously covered, eradication beyond the 1,500 ft. zone in new territory west of the nursery, and eradication beyond the mile zone on Martha Creek and all its branches to their heads. After this work was completed, a re-check of the newly eradicated territory was made. R. sanguineum, R. bracteosum and R. lacustre are the only Ribes in the vicinity of the nursery. The R. sanguineum was eradicated previously only to a 1,500 ft. radius from the nursery. This year, the entire hillside west of the nursery was scouted and the R. sanguineum removed to about 2,500 feet in this direction, or to the crest of the ridge. The R. bracteosum had been eradicated to a mile limit from the nursery. This year, the stream type territory (the normal habitat of R. bracteosum) along Martha Creek and all its branches to their heads was gone over even beyond the mile zone, and R. bracteosum was removed. Martha Creek and its branches offer the most likely source of blister rust infection which would affect the nursery white pines, and by having the R. bracteosum eradicated from this region, the chance for

STILL CREEK AREA

MT. HOOD NATIONAL FOREST



STREAM TYPE ERADICATION   UPLAND ERADICATION

STREAM TYPE RE-ERADICATION   TO BE ERADICATED

ENCLOSED AREAS ARE WHITE PINE PLANTINGS

DATA BY E.W.LYLE OCT. 1930   TRACED BY H.F.GEIL 1931

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infection by wind-carried spores is largely removed, for the summer winds are principally from this direction. Also, the reproduction and spread of R. bracteosum down stream into the zone of possible infection is much reduced. R. lacustre is scarce, and is found only outside the mile zone at the head of Martha Creek.

To give as nearly perfect protection of the white pines in the nursery as would be practical and possible, I suggest that a recheck of the entire area covered to date be made next year, and thereafter a bi-annual recheck twice, or as often as recheck records show that it would be advisable. This year's records show that 138 man-days of labor were required in rechecking the whole area. At this rate, it will require three and a half weeks for two three-man crews to complete an entire recheck.

The main stream of Trout Creek which flows by the nursery will need to be rechecked regularly every two years at the most, as there is an annual reseeding of the R. bracteosum from dense growths of this currant beyond the mile zone.

The presence of blister rust on pines within the 1,500 ft. zone about the nursery, near to its boundary, is but a matter of a few years. It was found this year on R. bracteosum about a mile and a half south of the nursery, and on pines about six miles west.

TABLE NO. 4

RIBES ERADICATION

Species	Re-check		New Erad.		Totals	
	Number	F.L.S.	Number	F.L.S.	Number	F.L.S.
R.bracteosum	1,903	4,512	3,992	67,835	5,895	72,347
R.sanguineum	109	1,899	107	1,764	216	3,663
Totals	2,012	6,411	4,099	69,599	6,111	76,010

Area covered:

Re-check eradication

Stream type - 16½ miles (75 ft. wide).......150 acres

1,500 ft. zone...............................186 acres

New eradication

Stream type - 6¼ miles (50 ft. wide)....... 37.8 acres

Hillside type.............................. 40.0 acres

TABLE NO. 5

RATE OF ERADICATION

Month	Re-check Eradication: Stream Type Man-Days	Re-check Eradication: 1500 ft. Zone Man-Days	New Eradication: Stream Type Man-Days	New Eradication: Hillside Type Man-Days
June	16	18	32	2
July	26		109	
August	63	15		16
Totals	105	33	141	18

TABLE NO. 6

COST OF ERADICATION

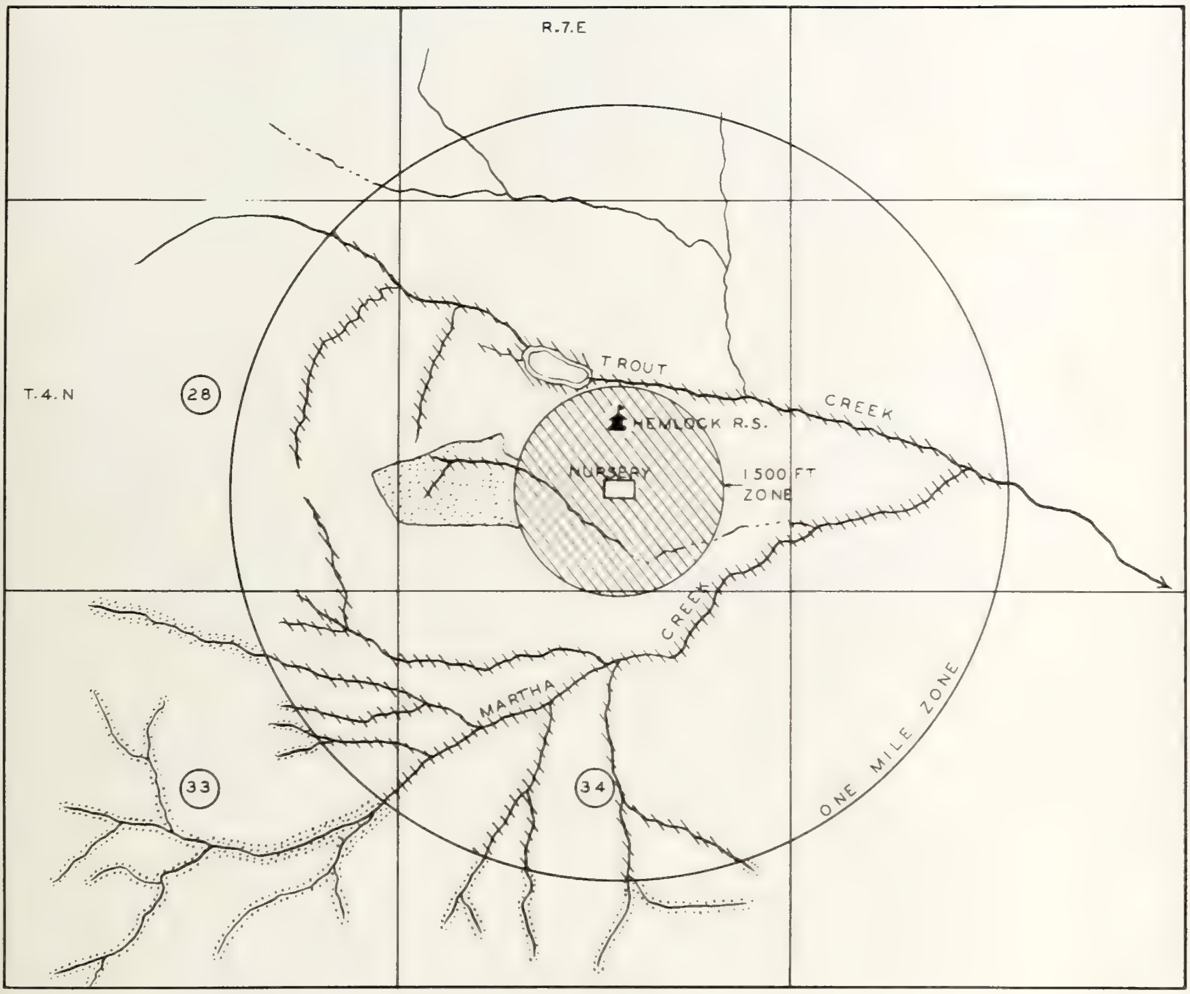
Type	Acres	Per Acre	Total
New eradication			
Stream type	37.8	$18.37	$ 694.43
Hillside type	40.0	2.22	88.80
Re-check			
Stream type	150.0	3.45	517.15
1500 ft. zone	186.0	.87	[illegible]
Totals	413.8		$1,432.73

EXPENSES

Item	Amount
Salaries	$612.90
Day labor	298.39
Meals	515.00
Transportation*	25.59
Equipment (twine, mattocks, etc.)	23.70
Total	$1,475.58

*Transportation was by Government truck, and the average rate of car expense during the summer (gas, oil, repairs and depreciation, at 4.62 cents per mile) was used in calculating the expense of transportation. Mileage was 554.

WIND RIVER EXPERIMENT STATION AREA



<u>ERADICATION</u>

UPLAND TYPE

STREAM TYPE BEYOND ONE MILE

<u>RE-ERADICATION</u>

ALL TYPES WITHIN 1500 FEET

STREAM TYPE WITHIN ONE MILE

SCALE 0 ¼ M ½ M

FIELD DATA BY E.W.LYLE OCT.1930.

TRACED BY H.F.GEIL FEB. 1931.

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The following species of white pine are now in the seed beds at Wind River Nursery:

Pinus strobus	(1-2)	29,000
P. lambertiana	(1-2)	2,000
P. flexilis	(1-2)	4,000
P. monticola	(2-2)	6,000
P. monticola	(1-2)	22,000
P. monticola	(2-0)	14,000
P. strobiformis	(1-0)	8,000
P. peuce	(1-0)	1,000

NURSERY SANITATION, PEAVY ARBORETUM

In 1929, the sanitation of the Peavy Arboretum was undertaken. 396 acres were covered by a crew, and 1,681 bushes were removed. It was thought best to cover the ground in the 1500-ft. zone again this year. Accordingly, a 5-man crew under the direction of Albert Arnst of the School of Forestry, Oregon State College, did the work. The crew and foreman were directed and paid by the School of Forestry. No records were kept of the results of the work. It was done on week ends, and totaled 33½ man-days. Walter Lund, who was crew foreman in 1929 in the initial eradication, gave the crew its instructions and supervised the work the first day. He was paid by our office.

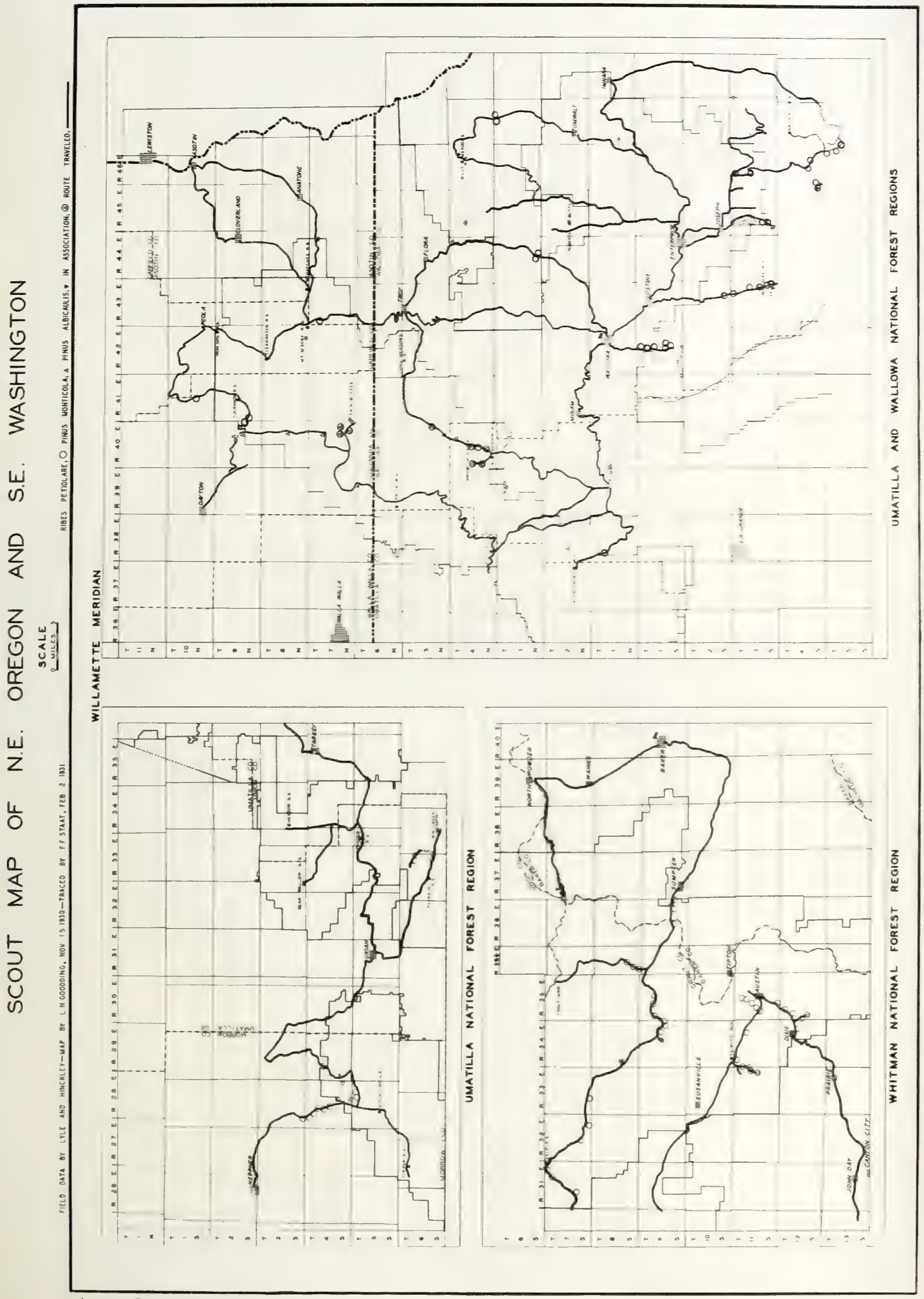
On October 22, 1930 Eldon Lyle spent one day in checking some of the land from which many Ribes had been removed. He found 37 R. sanguineum bushes, totaling about 624 feet of live stem. These bushes were in a heavy growth of poison ivy, most of the leaves of which had fallen exposing the R. sanguineum which had not shed its leaves.

The poison ivy in this area is the fly in the ointment, as those working in it are almost certain to experience severe poisoning. The result is that the poison ivy areas are never worked as well as they should be, and most of the ground not under cultivation or in dense timber is heavily grown up to ivy.

As the consequence of this check, it does not seem that the nursery should be given a permit to grow pines at the present time.

SCOUTING FOR BLISTER RUST IN OREGON, 1930

In this report, consideration is not given Bergen Creek, Eagle Creek, Rhododendron or other sections in which blister rust is known to be common or in which special work was done. It is felt also that infection on currants, except in localities where its presence shows distant spread over that recorded last year or where it is in association with white pine, is not significant; consequently no reference is made to it. An effort has been made to locate definitely many points where pines and Ribes are



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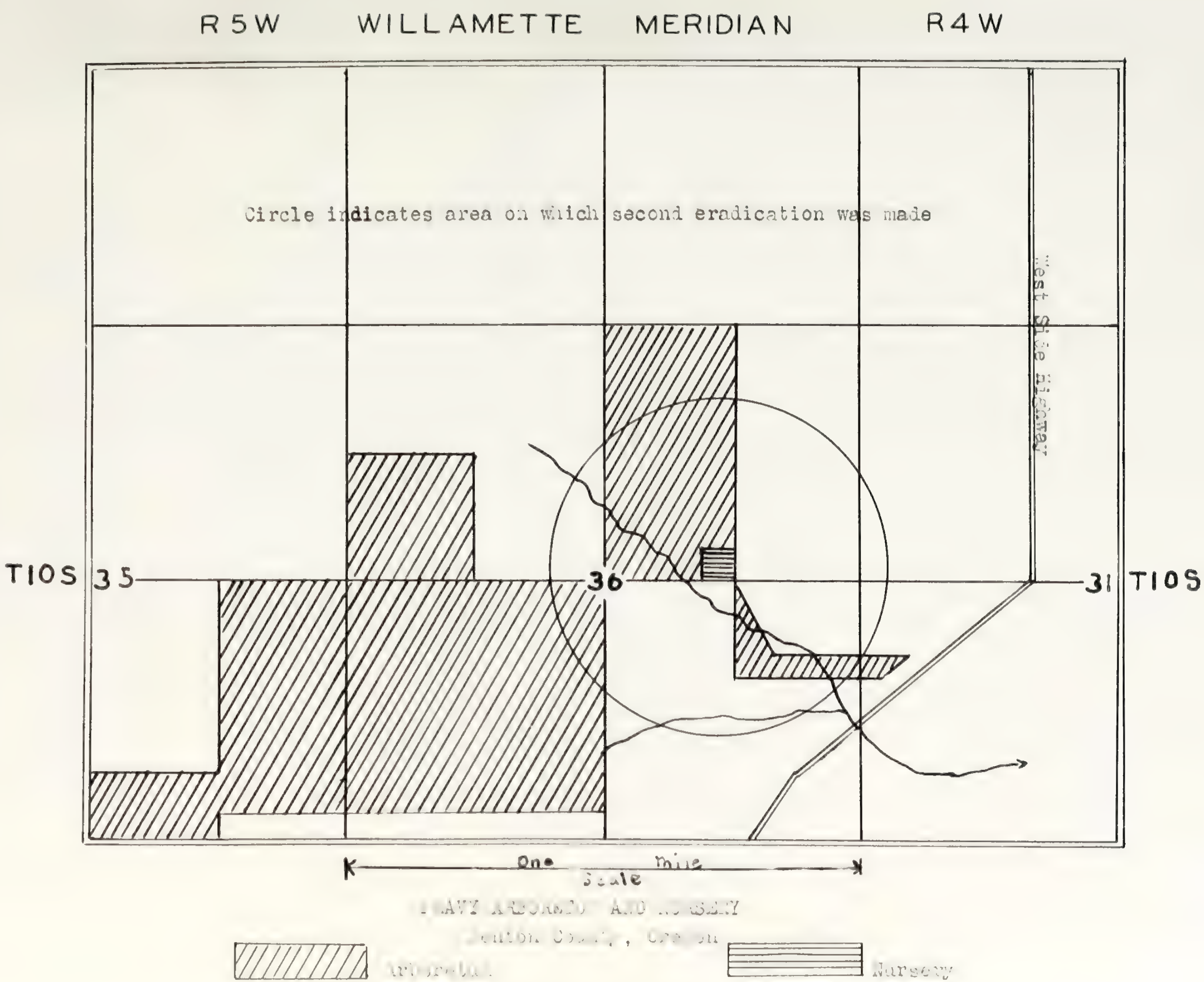

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associated, and in some places such as along the coast in Curry County definite location has been given to patches of R. bracteosum readily accessible for inspection.

Because of the heavy infection found in the Cochran region last year, considerable scouting was done in that region during the spring with hope of locating the source of the aecial spread. No pines were located. Similarly, the region above Estacada was scouted as far back as passable roads permitted. While planted white pines are rather common there, in no place was a likely association with Ribes found.

The trees at the Peavy Arboretum were examined carefully. The rust has never been found in that locality to date.

Following a normal expectation of finding blister rust east of the mountains where R. petiolare is associated with pines and where slight Ribes infection was found last year, the region east of the crest of the Cascades in the Mt. Hood Forest and south, was carefully scouted. With the exception of a single tiny spot on a leaf of R. petiolare, no infection of any kind was found there until fall. The single leaf was found June 26, on Bear Springs Creek. No more infection was found there until October 2, when by a most painstaking examination along the stream for a mile two locations were found; one, a single leaf, and one consisting of six leaves. This is an indication of the very slight intensification which took place in this region. Indications for all of western Oregon are much the same, though some new infection centers were found where conditions seemed more favorable, and where moderate intensification had taken place.

In August a scouting trip was made to southwestern Oregon, but nothing was found. It was felt at the time that infection might be located in a month or so, but this too failed to materialize.

Considerable scouting was done in the fall at the headwaters of streams in the Cascade region to locate pine infections. This work resulted in finding infected pines at the head of the south fork of Roaring River in Clackamas County and near Independence Ranger Station in Linn County. The last named location is the farthest point south at which pine infection has been located.

Scouting more intensive and more extensive than has been undertaken previously was carried on in northeastern Oregon. While no infection was found, many localities in which western white or whitebark pine grows in association with R. petiolare were found. The accompanying maps show the location of these associations.

The following table reveals some of the results of scouting done. Where pine infection was found, an attempt was made to determine the age of the wood infected, but study plots were not established at any of the points.

A careful survey was made of the Still Creek planting. The findings indicate that eradication was begun none too soon. In fact, serious damage is almost sure to occur in parts of the planting in spite of the work that has been done. Notes follow the map showing the pine infections in this region, giving some significant observations.

[illegible] inoculated, and in some places such as along the coast it [illegible] definite location has been given. So [illegible] readily accessible for inspection.

A careful survey was made of the [illegible] Creek planting. The findings indicate that eradication was begun none too soon. In fact, serious damage is almost sure to occur in parts of the planting in spite of the work that had been done. [illegible] the pine infections in this region, giving some significant observations. [illegible] In no place was a likely association with Ribes found.

The [illegible] has never been found in [illegible].

[illegible] a normal [illegible] of the mountains [illegible] of the Cascades in [illegible] with the exception of a single [illegible] on a leaf of R. [illegible], infection of any kind was found [illegible] found June 25, on four [illegible] leaves. [illegible] until [illegible] for a mile two locations were found [illegible] consisting of six leaves. [illegible] intensification [illegible] took place in this region. [illegible] western Oregon [illegible] found [illegible] fication had taken place.

In August a scouting trip was made to [illegible] nothing was found. It was [illegible] located in a month or so, but [illegible] failed to [illegible].

Considerable scouting was done in the [illegible] Ribes in the [illegible] region [illegible] resulted in finding [illegible] in Lane County. The last [illegible] which pine infection has been [illegible].

Scouting more [illegible] which previously was [illegible] infection was found [illegible] with pine areas in [illegible] accompanying maps show the location [illegible].

The following table [illegible] where pine infection was found, [illegible] of the most infected, [illegible] study plots were [illegible] points.

TABLE NO. 7

RECORD OF BLISTER RUST INFECTIONS ON RIBES IN OREGON, 1930

County	Region	T.	R.	S.	Host	Number Exam-ined	Number In-fec-ted	Per Cent Infec-ted Leaves	Per Cent Infected Surface Ure-dinia	Per Cent Infected Surface Te-lia	Per Cent Infected Surface Necro-tic	Asso-ciation	Inspector	Date 1930
Benton	Mary's Peak	[illegible]	7W	22	R. bract.	50	2	10	0	100	0	Very poor	Sipe, Hinckley	9-8
Marion	Silver Cr. Falls	8S	1E	11	R. bract.	25	1	1 leaf	0	100	0	Very poor	Sipe	9-6
	Copper Creek	8S	3E	19	R. bract.	70	1	2	0	100	0	Excellent	Coleman	9-15
	Breitenbush	9S	7E	20	R. bract.	50	1	1	0	100	0	Good	Reed, Goodding	9-5
	Breitenbush River	9S	6E	29	R. bract.	50	1	5	0	50	50	Very poor	Sipe	9-3
	Detroit	10S	5E	6	R. bract.	100	5	10	0	100	0	Very poor	Reed, Sipe, Hinckley, Goodding	9-8
Linn	Independence Ranger Station	11S	7E	10	R. bract.	50	2	5	0	100	0	Good	Lyle, Goodding	10-11
	Independence Ranger Station	11S	7E	10	R. sang.	2	2	80	0	75	25	Excellent	Lyle, Goodding	10-11
	Thomas Creek	10S	1E	5	R. bract.	50	2	2	0	100	0	Poor	Sipe	8-30
	Roaring River	11S	1E	6	R. bract.	100	2	2	0	100	0	Poor	Sipe	8-30
Wasco	Bear Springs Ck.	6S	10E	33	R. pet.	200	1	1 leaf	100	0	0	Poor	Goodding	6-26
	Bear Springs Ck.	5S	10E	33	R. pet.	400	2	0.1	0	75	25	Poor	Goodding, Lyle	10-3

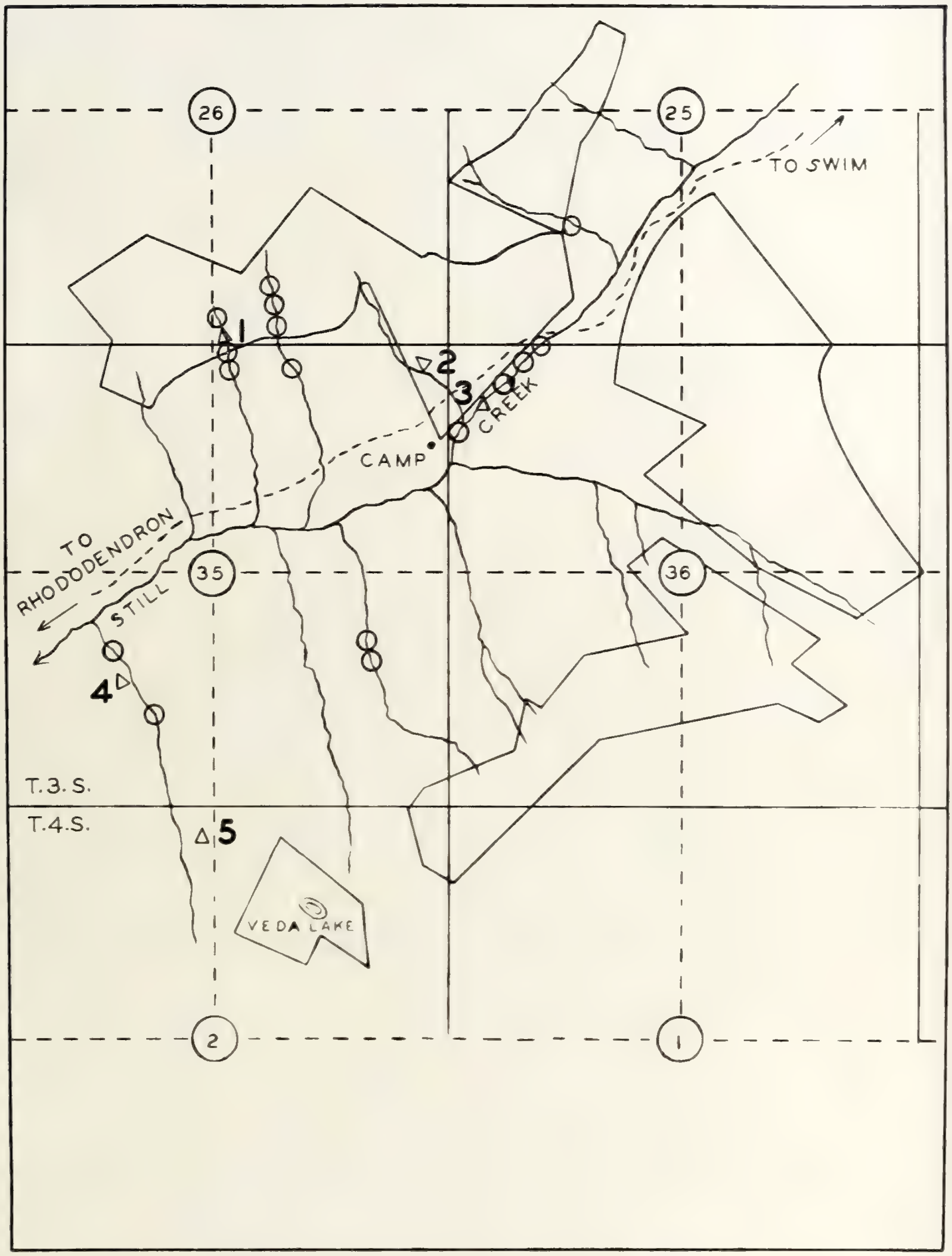
TABLE NO. 8

RECORD OF BLISTER RUST INFECTIONS ON PINES IN OREGON, 1930

County	Region	T.	R.	Sec.	Host	Number Examined	Number Infected	Date	Inspector	Remarks
Clackamas	Still Creek	3S	8E	26	P. monticola	15	3	8-28	Sipe, Lyle, Goodding	Infected 1925
		3S	8E	35	"	10	2	8-7	Coleman, Locke	Infected 1926
		3S	5E	35	"	25	1	8-7	Goodall	Infected 1925
		3S	8E	35	"	100	10	9-5	Lyle	Infected '25,'26
		4S	8E	2	"	15	1	9-7	Coleman	Infected '20, '25, '26, '27
	Roaring River	5S	6E	7	"	150	1	9-5	Lund, Dickey	Infected 1925
		5S	6E	7	"	100	1	9-6	Lund, Dickey	Infected 1925
	Minto Creek	11S	7E	26	"	50	2	9-20	Lyle	Infected 1925
		11S	7E	5,10 15,22 26	"	300	15	10-11	Lyle, Goodding	Very heavy. Infected 1925 or before.

STILL CREEK AREA

MT. HOOD NATIONAL FOREST



BLISTER RUST INFECTION 1930

Δ=ON PINE   O=ON RIBES   SCALE 0 ¼ M ½ M

DATA BY E.W.LYLE OCT.1930   TRACED BY H.F.GEIL FEB.1931

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OBSERVATIONS OF STILL CREEK WHITE PINE INFECTIONS, 1930

1. Ten white pines were found to be infected in this area along the stream and as far as 75 feet from the creek bed. The infection scars of the trees indicates that they became infected in 1926 and 1927. This stream was re-eradicated during September, 1930.

2. One tree was found to be infected. The stream has not been completely rechecked. Some R. lacustre and R. bracteosum remain.

3. Three infected pines were found. The stream has since been rechecked. The infection probably occurred during 1927.

4. Two white pines were infected on 1926 wood. No eradication of Ribes has been done along this stream. R. bracteosum and R. lacustre are abundant.

5. One white pine infected on 1926 wood. It is about 200 feet from the stream, where R. lacustre and R. bracteosum occur.

ECOLOGICAL STUDIES

During 1930, Mr. Sipe followed up the ecological work begun in previous years and collected data on plots already established. In many cases, data did not show anything more than was shown in the previous report; hence, each plot is discussed on the basis of the last report, and any additional data secured in 1930 were here appended.

Several plots are closed, either because the required information has been secured, or because the plot has failed to develop or has been destroyed.

PROJECT REGION, CRATER NATIONAL FOREST, OREGON

Plot I. In plot I many seedlings were observed at the beginning of the plot study. These seedlings grew fairly well for some years. During 1930 it was observed that practically all the Ribes had been smothered out by the growth of annual herbs, largely grasses. This was a sufficiently open place to give the grasses and annual herbs a foothold. The results would indicate that under certain conditions, grasses and herbs may play an important role in suppressing Ribes seedlings that come in after eradication.

Plot II. In this plot, the rapid growth of willows seemed to be suppressing the Ribes materially, although not killing them.

Plot III. No R. cruentum seedlings are yet appearing. The plot is probably too shady to allow germination of seeds of this species.

Plot IV. Closed.

Plot V. No individual plant data taken in 1930.

Plot V-a. Same as indicated in 1929 report. The conclusions in 1929 can be taken as the final conclusions for this plot study, as no further developments are likely to result. Closed.

Plot VI. Coniferous shade on this plot is gradually increasing, and a slight effect can be noticed on the Ribes. They seem somewhat less thrifty, and show less new growth.

Plot VI-a. This plot was destroyed by vandals who pulled up all the numbered stakes and threw them away. Closed.

Plots VII and VIII. No seedlings of Ribes were found on these plots in 1930. Closed.

Plot IX. No seedling Ribes were found here during 1930. The conclusions from the plot are essentially as in the 1929 report.

Plot X. Nothing new has developed since the 1929 report. During the period covered by this study, the R. binominatum show no invasion of the eradicated territory, and very little resprouting from old crowns or missed plants.

Plot XI. Same as 1929. Sub-plot B showed good continued growth of Ribes on lightly burned plot, with no Ribes on sub-plots A or C.

Plot XII. No seedling Ribes were found here. This plot is doubtless in too shady a location to expect any Ribes seedlings to appear. See 1929 report.

Plot XIII. Not checked by individual plants in 1930. Should be so checked in 1931.

Plot XIV. Closed.

Plot XV. No Ribes seedlings were found here. Disturbance of the duff alone, in this case, was not sufficient to stimulate dormant Ribes seeds to grow.

Plot XVI. Several small seedlings were found on disturbed places in this plot, which were marked for observation next year. This plot differed from Plot XV by being more open to sunlight.

Plot IV. Closed.

Plot V. No individual plant data taken in 1930.

Plot V-A. Same as indicated in 1929 report. The conclusions in 1929 can be taken as the final conclusions for this plot since no further developments are likely to result. Closed.

Plot VI. Coniferous shade on this plot is gradually increasing and a slight effect can be noticed on the Ribes. They seem somewhat less thrifty, and show less new growth.

Plot VI-A. This plot was destroyed by vandals who pulled up all the numbered stakes and threw them away. Closed.

Plots VII and VIII. No seedlings of Ribes were found on these plots in 1930. Closed.

Plot IX. No seedling Ribes were found here during 1930. The conclusions from the plot are essentially as in the 1929 report.

Plot X. Nothing new has developed since the 1929 report. During the period covered by this study, the R. bracteosum made no invasion of the unoccupied territory, and very little reproduction from old crowns or mixed plants.

Plot XI. Same as 1929. Sub-plot 1 showed good continued growth of Ribes on lightly burned plot, with no Ribes on sub-plots 2 or 3.

Plot XII. No seedling Ribes were found here. This plot is doubtless in too shady a location to expect any Ribes seedlings to appear. See 1929 report.

Plot XIII. Not checked by individual plants in 1930. Should be so checked in 1931.

Plot XIV. Closed.

Plot XV. No Ribes seedlings were found here. Disturbance of the duff alone, in this case, was not sufficient to stimulate dormant Ribes seeds to grow.

Plot XVI. Several small seedlings were found in disturbed places in this plot, which were marked for observation next year. This plot differs from plot XV by being more open to sunlight.

Plot XVII. Individual data not taken on plants this year, but should be taken in 1931 if possible.

Plot XVIII. A few R. erythrocarpum plants were coming in on this plot, one from a missed crown, and three or four from missed fragments under a log.

STILL CREEK AREA

The ecology work of the Still Creek area is closed. Because of the rapid invasion of blister rust here, it has not been deemed advisable to leave any patches of Ribes within the planting; hence, all ecology plots in this area have been abandoned.

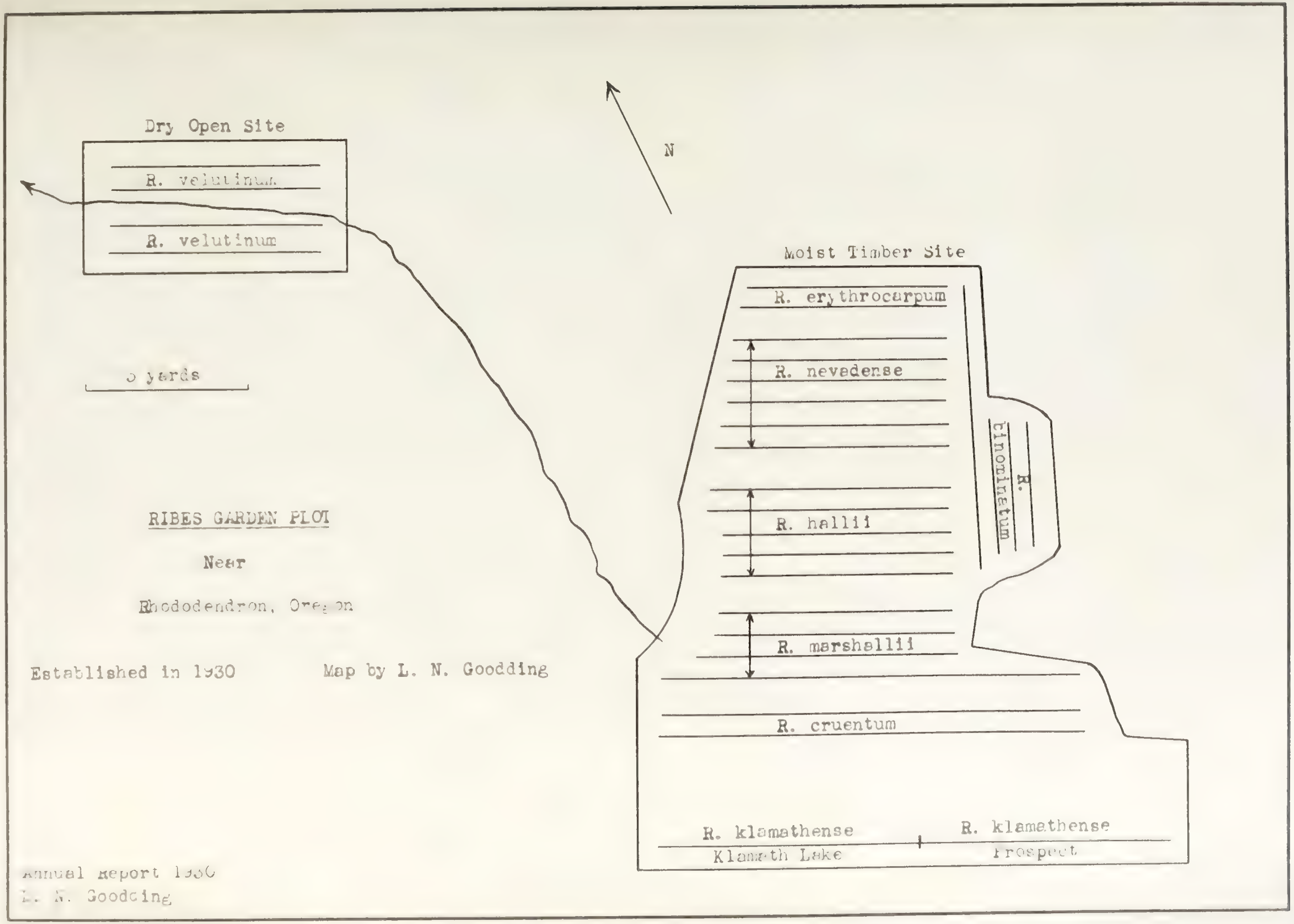
RIBES COLLECTIONS FOR CHEMICAL INVESTIGATIONS

Mr. Sipe spent much time during the period from June 15 to August 1 in collecting material for some of Mr. Offord's experiments. First, a collection was made of R. erythrocarpum for histological work. This was preserved in alcohol, and stored for shipping. At the same time collections were begun for starch analyses. These consisted of definite amounts of roots, leaves and stems of the current season, one year old and older stems of R. cereum and R. erythrocarpum. After collecting each species at 14-day intervals through the period, all material was later shipped to Mr. Offord's office in Berkeley.

EXPERIMENTAL RIBES GARDEN

Near the close of the season collections of Ribes from southern Oregon were made for use in experimental blister rust inoculation work. In the vicinity of Rhododendron, where heavy infections of blister rust on white pines have already been found, an area was cleared and prepared for the garden. During September Hinckley and Sipe made a trip to southern Oregon and collected 60 to 70 good plants of the most important Ribes species of that region, packed them in wet moss and brought them back to Corvallis. There they were left in storage for some time, but were kept moist. The Ribes species collected were:

- R. erythrocarpum from Crater National Park
- R. hallii from Union Creek, Crater National Forest
- R. binominatum from Union Creek, Crater National Forest
- R. cruentum from Prospect
- R. klamathense from Prospect


Dry Open Site
R. velutinum
R. velutinum
N
Moist Timber Site
R. erythrocarpum
R. nevedense
R. tinominatum
R. hallii
R. marshallii
R. cruentum
R. klamathense
Klamath Lake
R. klamathense
Prospect
yards
RIBES GARDEN PLOT
Near
Rhododendron, Oregon
Established in 1930
Map by L. N. Goodding
Annual Report 1930
L. N. Goodding

R. klamathense from Klamath lake shores
R. velutinum from near Klamath Lake
R. marshallii from near Oregon Caves
R. nevadense from near Oregon Caves

These Ribes were later taken by Goodding and Lyle and planted in the Ribes garden near Rhododendron.

The plants are all southern Oregon species, and have not yet been subjected to blister rust infection in the field. There are 50 or 60 excellent plants of R. sanguineum next to the garden plot. The susceptibility of this species has been quite definitely established, and it can be used for comparison with the other species. The plan is to carry out artificial inoculation experiments on each species, to determine as far as possible the susceptibility of each. Should there be sufficient growth during the spring of 1931, this work will be begun at that time by the Office of Forest Pathology under Mr. Lachmund's direction.

RIBES SEED COLLECTIONS AND DISTRIBUTIONS

During the 1930 season a number of seed collections were made of various species of currants and gooseberries. Part of the seeds were turned over to D. R. Miller at Moscow for germination experiments. The rest were placed in the hands of the Department of Horticulture, Oregon State College.

The following is the complete list of seed collections made during the season: R. sanguineum, R. cereum, R. aureum, R. petiolare, R. klamathense, R. velutinum, R. cognatum, R. gooddingii, R. glutinosum, R. irriguum, R. binominatum, R. divaricatum and R. niveum. Seeds of all these except R. petiolare, R. divaricatum and R. niveum were sent to Miller. Seeds of all except R. sanguineum, R. cereum, R. aureum and R. glutinosum were supplied to the Horticulture Department.

Seeds from 1927 collections of the following species were also sent to Miller for his experiments: R. aureum, R. bracteosum, R. cereum, R. erythrocarpum, R. petiolare, R. sanguineum, R. binominatum, R. cruentum, R. klamathense, R. lobbii, R. marshallii, R. niveum and R. velutinum. These seeds had been dried, and some of them were used by the Oregon State College Department of Horticulture with poor success last year. The collections of last season were not allowed to dry out and better results are expected of them.

RIBES BUSH COLLECTIONS

Besides the collections made for the Ribes garden at Rhododendron, plants of several species were collected and turned over to the Horticulture

Department at the college for planting on the East Farm. There were: R. cereum, R. aureum, R. roesli (collected in California by Frank Patty), R. cognatum, R. niveum and R. gooddingii.

FUNGI COLLECTED ON RIBES

While scouting for blister rust the following fungi have been collected on Ribes. Most of them are purely saprophitic, but some (such as the leaf spots and rusts) are parasitic. The list is tentative as too little work has been done to enable us to give the correct species in all cases.

Leaf diseases:

Hormiactis ? sp. on R. bracteosum.
Septoria aurea var. on R. aureum.
Septoria ribis on R. viscosissimum and R. cruentum.
Gleosporium ribis on R. lacustre, R. bracteosum, R. petiolare and R. Klamathense.
Gleosporium ? sp. on R. bracteosum.
Puccinia grossulariae on R. glutinosum.
Puccinia parkerae on R. lacustre and R. petiolare.

Cane Fungi:

Neokeisslaria ribis ? on R. petiolare and R. bracteosum.
Pleonectria Berolinensis Sacc. on R. cognatum and R. Klamathense (rare).
Diplodina ? sp. on R. Klamathense.
Rhyncophoma raduloides on R. bracteosum.
Diplodina grossulariae on R. triste.
Calospora ? sp. on R. bracteosum.
Plowrightia ribesia on R. irriguum, cultivated gooseberry and on R. vulgare.
Ophiobolus sp. on R. sanguineum.
Gibberidea sp. on R. petiolare.
Gibberidea sp. on R. cognatum.
Cenangium sp. on R. cognatum and R. watsonianum.
Zignoella sp. on R. cognatum.
Rossilinia sp. on R. petiolare.
Rossilinia sp. on R. triste.
Mastomyces ? sp. on R. petiolare.
Didymosphaeria ? sp. on R. bracteosum.
Aposphaeria sp. on R. watsonianum.
Nectria sp. on R. bracteosum.
Melogramma sp. on R. sanguineum
Dendrophoma sp. on R. watsonianum.
Coniothyrium sp. on R. bracteosum.
Phialea ? sp. on R. marshallii.

Department at the college for planting on the East Farm. These were: R. cereum, R. aureum, R. roezlii (collected in California by Frank Bailey), R. cognatum, R. niveum and R. goodingii.

FUNGI COLLECTED ON RIBES

While according to [illegible] that the following fungi have been collected on Ribes. Most of them are purely saprophytic, but some (such as the leaf spots and rusts) are parasitic. The list is tentative as too little work has been done to enable us to give the correct species in all cases.

Leaf diseases:

Ascochyta ? sp. on R. bracteosum.
Septoria aurea var. on R. aureum.
Septoria ribis on R. viscosissimum and R. cereum.
Gloeosporium ribis on R. lacustre, R. bracteosum, R. petiolare and R. klamathense.
Gloeosporium ? sp. on R. bracteosum.
Puccinia grossulariae on R. glutinosum.
Puccinia parkerae on R. lacustre and R. petiolare.

Cane fungi:

Botryosphaeria ribis ? on R. petiolare and R. bracteosum.
Pleonectria berolinensis Sacc. on R. cognatum and R. klamathense ([illegible]).
Diplodina ? sp. on R. klamathense.
Rhynchophoma raduloides on R. bracteosum.
Diplodina grossulariae on R. triste.
Calospora ? sp. on R. bracteosum.
Plowrightia ribesia on R. irriguum, cultivated gooseberry, and on R. vulgare.
Dothiorella sp. on R. sanguineum.
Gibberidea sp. on R. petiolare.
Gibberidea sp. on R. cognatum.
Cenangium sp. on R. cognatum and R. watsonianum.
Diplodia sp. on R. cognatum.
Rosellinia sp. on R. petiolare.
Rosellinia sp. on R. triste.
Mastomyces ? sp. on R. petiolare.
Didymosphaeria ? sp. on R. bracteosum.
Aposphaeria sp. on R. watsonianum.
Nectria sp. on R. bracteosum.
Melogramma sp. on R. cognatum.
Dendrophoma sp. on R. watsonianum.
Coniothyrium sp. on R. bracteosum.
Pezizella ? sp. on R. marshallii.

Cane Fungi (Continued)

Stictus ? sp. on R. sanguineum.
Scleroderris ? sp. on R. bracteosum.
Godronia sp. on R. bracteosum.
Godronia sp. on R. menziesii.
Godronia sp. on R. lacustre.
Godronia sp. on R. howellii (R. acerifolium).
Godronia sp. on R. cognatum.
Godronia sp. on R. sanguineum.
Godronia sp. on R. triste.
Godronia sp. on R. watsonianum.

FIELD SCOUTING

As time permitted, special trips were taken to make a study of Ribes species of southern Oregon and adjacent parts of California and Nevada. Collections were made of R. velutinum and R. cereum. These two species have some very pronounced variations that suggest varietal characters if not distinct species. They are to be given critical study later.

During the trip from Klamath Falls to Lakeview, some scouting was done for blister rust. R. aureum, an excellent host for the disease, was found growing abundantly along the shores of Sprague River and its small tributaries. This stream rises in the Fremont National Forest. It should be carefully scouted in 1931.

EDUCATIONAL ACTIVITIES

On September 22, a blister rust exhibit was set up at the Oregon State Fair at Salem, Oregon, space having been allotted for this purpose in the Forestry building by the State Board of Forestry. The exhibit occupied a conspicuous place, and was well illuminated by a flood light. It consisted of a mounted series of pictures from one of the envelopes of student materials, a five-wing exhibit set, a large pickled specimen of the aecial stage of blister rust, two six-tube exhibit boxes, a number of Riker mounts of the telial and uredinial stages, and cones of western white, white-bark and sugar pines. A large placard reading "A Matter of Life and Death to White Pines", printed in yellow upon a green background was placed above the display and aided in attracting attention. A number of copies of Miscellaneous Publication No. 23 and the Oregon "Questions and Answers on Blister Rust" for 1930 were placed with the exhibit, and many were taken away by people who were interested.

The exhibit was left until September 28, the final date of the fair.

In February 1930 an exhibit very similar to the above was placed with the Botany Department's display at the annual Educational Exposition at Oregon State College.

L. N. Goodding attended the meetings of the A.A.A.S. at Eugene, Oregon June 18-21. A blister rust exhibit was displayed in the hall where registration took place and where much of the routine business of the society was conducted. It elicited much favorable comment, and literature was distributed. A leading article in the Portland "Morning Oregonian", following the meeting, was based on the mimeographed "Questions and Answers" distributed with Miscellaneous Publication 23 and the key to the Ribes of Oregon.

The usual educational work--illustrated talks and distribution of literature--was done in the botany classes at Oregon State College and in the Corvallis High School.

BLISTER RUST DEMONSTRATION PLOT

In the spring, Goodding assisted by Professor H. P. Barss located an area of diseased pines and Ribes near Rhododendron to be used as a demonstration plot. Painted signs were placed on the trees and in clumps of Ribes, stating certain pertinent facts. Signs were also placed on the Mount Hood Loop highway at the point where the side road leads to the plot. Literature in the form of Questions and Answers and Miscellaneous Publication 23 was left at Williamson's and at Zig Zag Ranger Station. Mr. Williamson not only handed many of these to visitors, but also mailed others to those having leases on recreational sites. Some of the lessees undertook the eradication of the Ribes on their land, a procedure not advocated by our office.

FORM LETTERS

Two annual letters to Forest Service men (A) and to fire wardens, field inspectors and county agents and fruit inspectors (B) are presented in transcript:

(A)

Dear Sir:

Under separate cover I am sending you a small exhibit box of white pine blister rust. I hope you will be able to find a conspicuous place for it in your office.

In a short time you will receive a letter giving the general conspectus of the present blister rust situation in Oregon. You will find enclosed with it certain literature on the disease which I hope will prove of interest to you.

Your cooperation is sincerely appreciated.

Yours very truly,

The exhibit was left until September 28, the final date of the fair.

In February 1940, an exhibit very similar to the above was placed with the Botany Department's display at the annual Educational Exposition at Oregon State College.

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RIBES AND DEMONSTRATION PLOT

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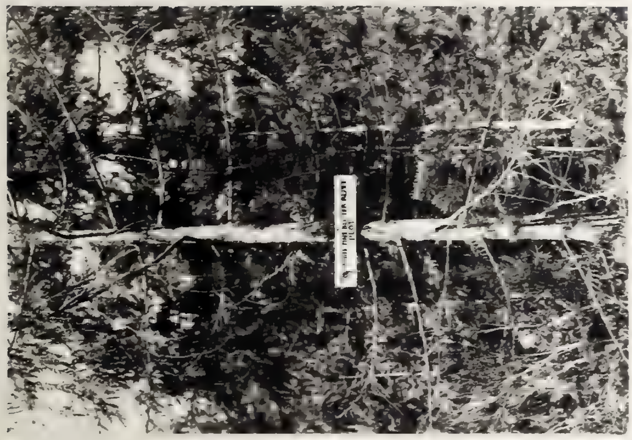
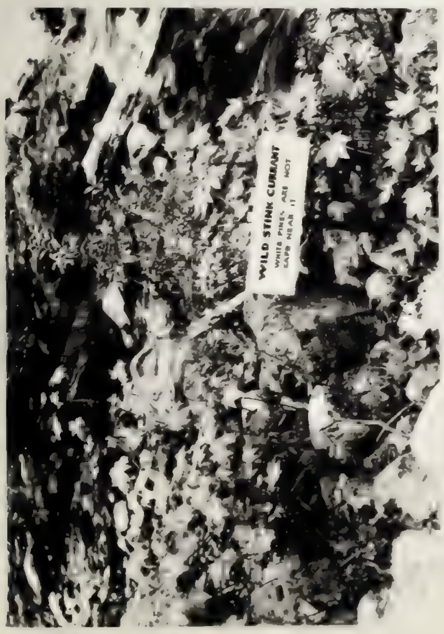
Your cooperation is sincerely appreciated.

Yours very truly,





RHODODENDRON DEMONSTRATION PLOT

Dear Sir:

I am sending you the season's reminder that white pine blister rust is still with us, in fact it is rapidly reaching serious proportions. If you are not acquainted with the disease read about it in the enclosed publications. You may be interested in doing so anyway.

Here are a few of the Oregon high lights on the disease:

1. It was discovered on currants in Oregon in 1926, three or possibly five years after it had entered the state.

2. Last season it was found on currants near the California line in Curry County and on the Metolius River in Jefferson County.

3. In 1929 "flags" (dead branches) caused on pines by the disease were evident in many places.

4. In 1930 some entire trees are dead and others are rapidly dying.

5. It has not been found on pines outside the Mt. Hood region, but indications point to infection.

6. Currant infection (which always precedes pine infection) is within the range of sugar pines in the coast range and in the Metolius region in the Cascades.

7. Control work is being carried on in the Still Creek region in Mt. Hood National Forest.

Please send us specimens of diseased pines or currants and gooseberries you suspect of having blister rust, and ask any questions you wish to about the disease.

Thanking you for your cooperation, I am

Yours very truly,

RIBES SUPPRESSION EXPERIMENTS

In contemplation of some experimental work in suppression of Ribes by means of grasses, the Corvallis office cooperated with Mr. Johnson at Missoula. After consulting with Professor Schoth, a tentative list of grasses was obtained. Letters were then written to different agronomists in the West asking their advice. As a result of correspondence with these men, after consulting several seed catalogues, certain grasses were chosen. I believe Mr. Johnson used some grasses or

grass mixtures not suggested in the following list. Results of this planting will be found in Johnson's 1930 report for Montana. The attached correspondence is pertinent to the subject.

Grasses Adapted to Various Northwest Forest Areas for
Probable Control of Ribes Species
(List prepared by H. A. Schoth, Oregon State)

A. Swampy areas

Reed canary grass -	Phalaris arundinacea
Creeping bent - -	Agrostis maritima
Mountain sedge - -	Carex sp. (Rip gut grass)
Reed fescue - -	Festuca arundinacea
Canada reed bent -	Calamagrostis canadensis

B. Areas with abundant moisture but not swampy

Red top - - - - - -	Agrostis alba
Meadow foxtail - -	Alopecurus pratensis
Velvet grass - -	Holcus lanatus
Reed fescue - - - -	Festuca arundinacea
Tall fescue - - - -	Festuca elatior

C. Medium dry areas but still having enough moisture to grow grasses well

Mountain brome - -	Bromus polyanthus
Smooth brome	Bromus inermis
Tall fescue - - -	Festuca elatior
Orchard grass - - -	Dactylis glomerata
Tall meadow oat grass -	Arrhenatherum elatius
Sweet vernal grass -	Anthoxanthum odoratum

D. Dry areas but still not too dry to grow certain grasses

Chewing fescue - -	Festuca rubra fallax
Sheeps fescue - - -	Festuca ovina
Red fescue - - - -	Festuca rubra
Hard fescue - - - -	Festuca duriuscula

The following are transcripts of letters relative to these experiments:

(a)

Dear Sir: 2-17-30

We are contemplating carrying on some experiments in brush suppression in forested areas. Can you recommend a grass, grasses or other forage plants for use along streams in the mountains where the brush has been removed and where rather heavy grazing is likely to occur? If so, please let me know where seed can best be obtained. In case the seed cannot be obtained on the open market, where and at what season can it be gathered in the field?

grass mixtures not suggested in the following list. Results of this planting will be found in Johnson's 1930 report for [illegible]. The attached correspondence is pertinent to the subject.

Grasses Adapted to Various Northwest Forest Areas for Probable Control of Other Species
(List prepared by H. A. Schoth, Oregon State)

A. Swampy areas

Reed canary grass - Phalaris arundinacea
Creeping bent - - Agrostis palustris
Mountain sedge - - Carex sp. (Slip gut grass)
Reed fescue - - - Festuca arundinacea
Canada reed bent - Calamagrostis canadensis

B. Areas with abundant moisture but not swampy

Red top - - - - - - Agrostis alba
Meadow foxtail - - Alopecurus pratensis
Velvet grass - - Holcus lanatus
Reed fescue - - - - Festuca arundinacea
Tall fescue - - - Festuca elatior

C. Medium dry areas but still having enough moisture to grow grasses and

Mountain brome - - Bromus polyanthus
Smooth brome Bromus inermis
Tall fescue - - Festuca elatior
Orchard grass - - - Dactylis glomerata
Tall meadow oat grass - Arrhenatherum elatius
Sweet vernal grass - Anthoxanthum odoratum

D. Dry areas but still not too dry to grow certain grasses

Chewing fescue - - Festuca rubra fallax
Sheeps fescue - - - Festuca ovina
Red fescue - - - - Festuca rubra
Hard fescue - - - - Festuca duriuscula

The following are transcripts of letters relative to these experiments:

(a)

Dear Sir: 3-1-?

We are contemplating carrying on some experiments in brush suppression in forested areas. Can you recommend a grass, grasses or other forage plants for use along streams in the mountains where the brush has been removed and where rather heavy grazing is likely to occur? If so, please let me know where seed can best be obtained. In case the seed cannot be obtained on the open market, where and at what season can it be gathered in the field?

Thanking you for any information you can give us, I am

Yours very truly,

Letter (a) was sent to the following:

C. R. Fleming, Nevada Agricultural College, Reno, Nevada.
A. W. Sampson, U. of Cal., Berkeley, California.
Alvin Kezer, Colorado Agricultural College, Ft. Collins.
Dr. Aven Nelson, U. of Wyoming. Laramie, Wyoming.
J. O. Stewart, Forest Service, Ogden, Utah.
D. B. Swingle, Montana State College, Bozeman, Montana.
F. W. Gail, U. of Idaho, Moscow, Idaho.
C. P. Wilson, New Mexico State College, New Mexico.
Dr. Harold St. John, Washington State College, Pullman, Washington.

(b)

Dear Johnson

3-10-30

I was talking with Wyckoff a couple of days ago and told him about our plan to sow grass seed in some of your burned-over land in the nursery at Haugan. He thought favorably of the undertaking. I have received letters from several different agronomists regarding grasses best suited for such purposes. The consensus of opinion seems to be that redtop, blue grass, timothy, the slender wheat grass, and one of the brome grasses are the best for our use. Our station here suggests the reed canary grass for swamp areas. I hope we can try three or four different plots in the nursery. Perhaps we can judge from the results we obtain what our best bet will be in similar situations. I should like very much to try the reed canary grass in one plot, a mixture of timothy and redtop in another, blue grass in another, and brome and slender wheat in another, providing, of course, we can obtain seed of all of these.

How much of an area would you like to sow? Will you purchase the seed or shall I do so? How early should the area be planted? I should think the earlier the better.

Yours very truly,

PRE-ERADICATION, CRATER LAKE

On August 5-7 Strong, Benedict, Riley, Sipe and I made some observations on conditions in Crater National Park and conferred with Solinsky, Godfrey, Coffman and Vint. Owing to certain difficulties of eradication and uncertainty of opinion regarding its advisability in

Thanking you for any information you can give me, I am

Yours very truly,

Letter (a) was sent to the following:

C. E. Fleming, Nevada Agricultural College, Reno, Nevada.
A. W. Sampson, U. of Cal., Berkeley, California.
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J. G. Stewart, Forest Service, Ogden, Utah.
D. F. [illegible], Montana State College, Bozeman, Montana.
F. W. Gail, U. of Idaho, Moscow, Idaho.
C. F. [illegible], New Mexico State College, New Mexico.
Dr. Harold St. John, Washington State College, Pullman, Washington.

(b)

Dear Johnson: 3-10-33

I was talking with [illegible] a couple of days ago and told him about our plan to sow grass seed in some of your burned-over land in the nursery at Haugan. He thought favorably of the undertaking. I have received letters from several different agronomists regarding grasses best suited for such purposes. The consensus of opinion seems to be that redtop, blue grass, timothy, the slender wheat grass, and one of the brome grasses are the best for our use. One station here suggests the reed canary grass for swamp areas. I hope we can try three or four different plots in the nursery. Perhaps we can judge from the results we obtain what our best bet will be in similar situations. I should like very much to try the reed canary grass in one plot, a mixture of timothy and redtop in another, blue grass in another, and brome and slender wheat in another, providing, of course, we can obtain seed of all of these.

How much of an area would you like to sow? Will you purchase the seed or shall I do so? How early should the area be planted? I should think the earlier the better.

Yours very truly,

[illegible]-REGENERATION, GLACIER PARK

On August [illegible] Strong, Benedict, Riley, Pipe and I made some observations on conditions in Glacier National Park and conferred with [illegible], Godfrey, Coffman and [illegible]. Owing to certain differences of application and uncertainty of opinion regarding its advisability in

occurs [illegible]

certain sections, we unanimously decided to postpone any eradication program for the next year and probably for the following one also. For the same reason we did not make estimates on probable costs of eradication. We wish to call your attention to certain conditions existing in the park.

Around the rim there are areas with stands of white-bark pine and mountain hemlock varying from pure stands of the former to pure stands of the latter. In many of these stands R. erythrocarpum forms a dense carpet. Around the rim, the chief problem of eradication would be with this species. R. hallii is rather abundant in places and R. cereum and R. lacustre are less frequent. These, however, present nothing new or difficult in eradication. R. erythrocarpum acts as a binder for the shifting lava ash, and without argument is one of the outstanding plants of the park in beauty. In the spring it is covered with abundant flowers, and in the fall it is a glowing mass of red fruits. At the edges of the patches, the trailing stems pull readily, but where they break from the roots which are numerous along the stems, they leave pieces of detached stem which can be expected to act as bits of crown. Back from the edges toward the center of the patches, hand pulling becomes increasingly difficult. Hand tools or some type of diggers would be necessary. As an alternative we could resort to chemical eradication. This would necessitate experimental work in advance.

There are extensive areas southeast and west of the rim at a lower altitude where there are varying amounts of western white pine. In some places protection seems warranted. The chief species of Ribes are R. cereum, R. erythrocarpum, R. binominatum and R. hallii. These are for the most part confined to the rims and the steep slopes of canyons. In no place is there a true stream type Ribes. R. binominatum is abundant, and owing to its trailing habits and the loose soil in which it grows would probably be the most difficult to eradicate.

With this brief outline of conditions for a background, allow me to give you an idea of the attitude of the park service. They are, so to speak, "between the devil and the deep blue sea". The principal region needing protection from the standpoint of the scenery is the rim. The landscape men object seriously to disturbing the natural appearance by the eradication of one species or the introduction of another. The artistic and aesthetic value of R. erythrocarpum can not be denied. They desire to save it for its beauty and for its value as a soil binder. They also wish to save the white-bark pine which in places is the only tree and which certainly is both artistic and aesthetic. They wish the pines protected, but do not wish the Ribes destroyed. Admitting that this is necessary, they object to chemical eradication because it makes the landscape unsightly and kills other plants as well as the Ribes. They object to eradication by hand and by hand tools because it destroys the beauty and removes the plants which bind the soil. Owing to this attitude, to the fact that blister rust is not known to be near the park at present, and to the fact that the job of eradication is not sufficiently large that

certain sections, we unanimously decided to postpone any eradication program for the next year and probably for the following one also. For the same reason we did not make estimates on probable costs of eradication. We wish to call your attention to certain conditions existing in the park.

Around the rim there are areas with stands of white-bark pine and mountain hemlock varying from pure stands of the former to pure stands of the latter. In many of these stands *R. erythrocarpum* forms a dense carpet. Around the rim, the chief problem of eradication would be with this species. *R. nevadense* is rather abundant in places and *R. cereum* and *R. lacustre* are less frequent. These, however, present nothing new or difficult in eradication. *R. erythrocarpum* acts as a binder for the shifting lava ash, and without argument is one of the outstanding plants of the park in beauty. In the spring it is covered with coral flowers, and in the fall it is a glowing mass of red fruits. At the edges of the patches, the trailing stems pull readily, but where they break from the roots which are numerous along the stems, they leave pieces of infected stem which can be expected to act as bits of crown. Back from the edges toward the center of the patches, hand pulling becomes increasingly difficult. Hand tools or some type of diggers would be necessary. As an alternative we could resort to chemical eradication. This would necessitate experimental work in advance.

There are extensive areas southeast and east of the rim in a lower altitude where there are varying amounts of western white pine. In some places protection seems warranted. The chief species of Ribes are *R. cereum*, *R. erythrocarpum*, *R. binominatum* and *R. nevadense*. These are for the most part confined to the rims and the steep slopes of canyons. In no place is there a true stream type Ribes. *R. binominatum* is abundant, and owing to its trailing habits and the loose soil in which it grows would probably be the most difficult to eradicate.

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it could not be done promptly when the emergency arises, I made this proposition to the park officials, a part of which by the very nature of things is subject to approval; viz., that we postpone eradication for probably two years and during that time get all information possible on the susceptibility of the Ribes of this region, particularly of R. erythrocarpum and ascertain by scouting the advance of the disease toward the park each season. I thought the best method to use in ascertaining the susceptibility was one suggested by Mr. Sipe last year, i.e., introduction of plants of the species we wish to study into the Rhododendron region. I have talked this matter over with Lachmund, and he has agreed to take the necessary data each season if we can establish the plot. My idea is to make the experiment of sufficient proportions to give adequate information and to make it apply to all the important species of the general region, namely: R. erythrocarpum, R. binominatum, R. hallii, R. cruentum and R. klamathense. R. cereum and R. lacustre have been studied sufficiently in other sections to make it unnecessary to include them.

(This report was prepared by L. N. Goodding in collaboration with C. C. Strong.)

EAGLE CREEK PLOT SITE SURVEY

By

E. L. Joy, Jr. Forester

White pine blister rust was first found on pines in the Eagle Creek drainage in 1928 by Lyle. This area of infection is 7 to 9 miles from the Columbia River Highway in township 1 north, range 8 east, sections 8, 17, 19 and 20 on the Bull Run Division of the Mt. Hood National Forest, Hood River County, Oregon.

Below the 7-mile point the stream flows through a deep rocky canyon in a series of waterfalls and rapids. Because the exposed rock formation is very dry and the canyon deep and narrow, there are very few white pines and Ribes near the stream. Above the 7-mile point the area, which is an old burn, is more open and supports a scattered stand of coniferous reproduction 11 to 20 years old, a large per cent of which is western white pine. Most of these pines grow in the moist stream bottoms.

On this area also grows an abundance of R. bracteosum and R. lacustre in patches along the streams and R. sanguineum on the benches and slopes. It is in this locality above the 7-mile point that the disease, probably of 1923 origin, is well established and widespread.

In the fall of 1929 Putnam and Goodding scouted here and made a study of the infection. The possibility of establishing a plot to study the effect of R. sanguineum was suggested when it was found that infected pines and R. sanguineum were on the area. Goodding, Joy, Myers and

it could not be done properly when the emergency arises, I made this proposition to the park officials, a part of which by the very nature of things is subject to approval; viz., that we postpone eradication for probably two years and during that time get all information possible on the susceptibility of the ribes of this region, particularly of R. erythrocarpum and ascertain by scouting the advance of the disease toward the park each season. I thought the best method to use in ascertaining the susceptibility was the suggested by Mr. [illegible] last year, i.e., introduction of plants of the species we wish to study into the Hudsonian region. I have talked this matter over with [illegible], and he has agreed to take the necessary data each season if we can establish the plots. My idea is to make the experiment of sufficient proportions to give adequate information and to have it apply to all the important species of the general region, namely: R. erythrocarpum, R. klamathense, R. hallii, R. cruentum and R. binominatum. R. cereum and R. lacustre have been studied sufficiently in other sections to make it unnecessary to include them.

(This report was prepared by L. N. Goodding in collaboration with [illegible] Strong.)

[illegible] CREEK PLOT SITE [illegible]

By

H. L. Joy, Jr. Forester

White pine blister rust was first found on pines in the [illegible] Creek drainage in 1927 by [illegible]. This area of infection is 6 to 8 miles from the Columbia River Highway in township 1 north, range 8 east, sections 5, 17, 19 and 20 on the Bull Run division of the Mt. Hood National Forest, Hood River County, Oregon.

Below the 7-mile point the stream flows through a long rocky canyon in a series of waterfalls and rapids. Because the exposed rock formation is very dry and the canyon deep and narrow, there are very few white pines and ribes near the stream. Above the 7-mile point the area, which is an old burn, is more open and supports a scattered stand of coniferous reproduction 15 to 25 years old, a large per cent of which is western white pine. Some of these pines grow in the moist stream bottoms.

On this area also grows an abundance of R. bracteosum and R. lacustre in patches along the streams and R. sanguineum on the benches and slopes. It is in this locality above the 7-mile point that the disease, probably of 1923 origin, is well established on white pine.

In the fall of 1929 [illegible] and Goodding [illegible] have made a study of the infection. The possibility of establishing a plot to study the effect of R. sanguineum was suggested when it was found that infected pines and R. sanguineum were on the area. [illegible]

Chapman made a survey in this region May 10-13, 1930 to determine the feasibility of establishing this plot. The following points were considered while making this survey:

1. Abundance of blister rust on white pines.
2. Nature of the association of white pines and R. sanguineum.
3. Quantity of Ribes other than R. sanguineum, that would have to be eradicated from the plot site and the area around the plot.
4. Nature of the topography of the region.
5. Accessibility of the area.

Infected white pines were found in all parts of this area, the heaviest infection near the streams but a considerable amount on the slopes. In order to determine the general infection conditions, data were taken on the trees of sample plots on the east side of Eagle Creek in the stream type (maximum of 200 feet from the stream), on the bench land (200-500 feet) and on the slope (500 to 2,500 feet). Following is a summary of these data:

TABLE NO. 1

DISTRIBUTION OF INFECTION AS FOUND NEAR THE STREAM ON THE BENCH LAND AND ON THE SLOPE

Plot Situation	No. Trees Exam.	No. Trees Infected	% Trees Infected	Total No. Cankers	No. Cankers Per Tree Exam.
Stream	37	28	75.7	190	5.14
Bench	47	22	46.8	44	0.94
Slope	28	9	32.1	15	0.54
Total	112	59	52.7	249	2.22

It is evident that, although infection is heaviest on trees near the streams there is a considerable amount on the trees of the slopes. Where patches of Ribes sanguineum were found the adjacent pines were heavily infected even on the upper slopes approximately one mile from Eagle Creek.

The cankers on the infected trees of the three sample plots were examined to determine the year of growth infected and the stage of development of each. A summary of these results is found in the following table:

TABLE NO. 2

SUMMARY OF ALL CANKERS EXAMINED ON THREE SAMPLE PLOTS [illegible] ON THE EAGLE CREEK INFECTION AREA

Year	First Symptoms	Juvenile	Pycnial Scars	Produced Aecia Once	Twice	Sev. Times	Total
1927	1	12	12	9	0	0	34
1926	1	29	41	31	0	0	102
1925	2	18	28	39	0	2	89
1924	0	2	4	10	0	1	17
1923	0	1	0	3	0	2	6
1922	0	0	0	0	0	0	0
1921	0	0	0	0	0	0	0
1920	0	0	0	0	0	0	0
1919	0	0	0	0	0	1	1
Total	4	62	85	92	0	6	249

Of the 249 cankers found on the 59 infected trees only one, that on growth made in 1919, is a positive clew to the probable year of origin of this infection center, presumably 1923. Two of the 6 cankers on 1923 growth could have originated in 1923 but if this is true there should be a few cankers on the growths made in 1922, 1921 and 1920 as well as 1923 and 1919. Also, if the original infection occurred in 1919, 1920, 1921 or 1922 the fruiting of this canker, which would normally be three years later, should have caused some cankers on the growths from 1920 to 1922 as well as a noticeable increase in the number of cankers on wood which was one year old during the first year of fruiting. By 1930 these cankers would have fruited two times or more. Such is not the case, according to the above summary.

Because of the above reasoning and the fact that 1923 was the year of origin of many pine infection centers due to favorable conditions we conclude that the most probable year of origin of this infection center was 1923. It is also believed that a thorough scouting of all the pines in this vicinity would reveal several more cankers on old growth that originated during the same year as the one found on 1919 growth.

Although R. sanguineum is quite generally distributed over this region, the larger patches or concentrations are on the upper slopes where the pines are very scattered. In general the association is not satisfactory for a study plot in this region.

A survey was made of the Ribes along Eagle Creek and its tributaries for a distance of one mile each way from the shelter house, which is approximately the location of the proposed plot. In this distance of two miles there are 23 tributaries to Eagle Creek, 15 year-round streams and 8 seeps. R. bracteosum is in scattered patches along Eagle Creek and part of the tributaries but in general is abundant. R. lacustre is also

abundant on part of the tributaries.

The slopes on both sides of Eagle Creek are very steep, in some places precipitous. There are many waterfalls, both on the main stream and its tributaries, several of these 50 to 100 feet high. Although there is a good trail from the Columbia Highway to this region, the area in the vicinity of the proposed plot site is not readily accessible.

Summarizing this survey, it was deemed inadvisable to establish a plot on Eagle Creek because of (1) the extremely large, difficult and expensive task of eradicating the undesirable Ribes; (2) the lack of sufficient pines and R. sanguineum in association for a satisfactory plot, (3) the inaccessibility of the area.

BLISTER RUST CONTROL WORK IN CALIFORNIA
1930

Blister rust control activities in California were continued as a cooperative project between the Bureau of Plant Industry and the California Department of Agriculture, California State Board of Forestry, College of Agriculture, University of California and the Department of Botany, University of California. There is given below the amendment to the basic memorandum of understanding, which was drawn up to cover the cooperative work for the fiscal year 1931 beginning July 1, 1930:

MEMORANDUM OF UNDERSTANDING
Between
THE BUREAU OF PLANT INDUSTRY, U. S. DEPARTMENT OF AGRICULTURE
and
THE CALIFORNIA DEPARTMENT OF AGRICULTURE - - - THE CALIFORNIA STATE BOARD OF FORESTRY - - and the COLLEGE OF AGRICULTURE and DEPARTMENT OF BOTANY, UNIVERSITY OF CALIFORNIA
Relative to
Cooperative White Pine Blister-Rust-Control Work in California.

Effective July 1, 1930

* * *

A. The BUREAU OF PLANT INDUSTRY agrees to:

(1) Pay the salaries and necessary travel expenses of one or more employees who shall conduct such work;

(2) Assist in systematically locating and destroying cultivated black currants (Ribes nigrum) under state authority;

(3) Conduct experiments in control reconnaissance and local Ribes eradication, demonstrate the practical application of control practices, and obtain data on the spread of the rust; and

(4) Coordinate control activities of the several cooperating states and agencies by furnishing regional leadership and supervision, and to provide employees and the cooperating agencies with blister rust subject matter and technical information.

B. The CALIFORNIA DEPARTMENT OF AGRICULTURE agrees to:

(1) Pay the salaries and expenses and direct the work of one or more men who shall, during the proper season, inspect plant shipments for violations of blister-rust quarantines;

(2) Use its regular employees, so far as their other duties permit, and direct their work in systematically locating and destroying cultivated black currants, scouting for white pine blister rust and inspecting nurseries for this disease;

BLISTER RUST CONTROL WORK IN CALIFORNIA
1920

Blister rust control activities in California were continued on a cooperative project between the Bureau of Plant Industry and the California Department of Agriculture, California State Board of Forestry, College of Agriculture, University of California and the Department of Botany, University of California. There is given below the amendment to the basic memorandum of understanding, which was drawn up to cover the cooperative work for the fiscal year 1921 beginning July 1, 1920:

MEMORANDUM OF UNDERSTANDING
between
THE BUREAU OF PLANT INDUSTRY, U. S. DEPARTMENT OF AGRICULTURE
and
THE CALIFORNIA DEPARTMENT OF AGRICULTURE - - - THE CALIFORNIA STATE BOARD OF FORESTRY - - and the COLLEGE OF AGRICULTURE and DEPARTMENT OF BOTANY, UNIVERSITY OF CALIFORNIA
Relative to
Cooperative White Pine Blister-Rust-Control Work in California.

Effective July 1, 1920

* * *

A. The BUREAU OF PLANT INDUSTRY agrees to:

(1) Pay the salaries and necessary travel expenses of one or more employees who shall conduct such work;
(2) Assist in systematically locating and destroying cultivated black currants (Ribes nigrum) under state authority;
(3) Conduct experiments in control (reconnaissance and local Ribes eradication), demonstrate the practical application of control practices, and obtain data on the spread of the rust; and
(4) Coordinate control activities of the several cooperating states and agencies by furnishing regional leadership and supervision, and to provide employees and the cooperating agencies with blister rust subject matter and technical information.

B. The CALIFORNIA DEPARTMENT OF AGRICULTURE agrees to:

(1) Pay the salaries and expenses and direct the work of one or more men who shall, during the proper season, inspect plant shipments for violations of blister-rust quarantines;
(2) Use its regular employees, so far as their other duties permit, and direct their work in systematically locating and destroying cultivated black currants, scouting for white pine blister rust and inspecting nurseries for this disease;

(3) Undertake such destruction of white pine or Ribes in California and such enforcement of state laws as may be necessary for the effective prosecution of blister-rust-control work; and

(4) Furnish the state leader in charge of blister-rust control work in California such office space as may be necessary for the proper conduct of his work.

C. The CALIFORNIA STATE BOARD OF FORESTRY agrees to:

(1) Use its regular employees, so far as their other duties permit, in systematically locating and eradicating cultivated black currants, scouting for white-pine blister rust and assisting in the compilation of information concerning location, ownership and volume of sugar pine stands as a basis for control work.

D. The COLLEGE OF AGRICULTURE, UNIVERSITY OF CALIFORNIA, agrees to:

(1) Assist employees of the Bureau of Plant Industry, through the University Division of Forestry, by furnishing available technical advice and records;

(2) Provide office and laboratory facilities, through the University Division of Forestry, for employees of the Bureau of Plant Industry who are stationed in California to conduct technical studies upon the feasibility of chemical eradication of Ribes.

E. The DEPARTMENT OF BOTANY, UNIVERSITY OF CALIFORNIA agrees to:

(1) Assist employees of the Bureau of Plant Industry engaged in technical investigation of the chemical eradication of Ribes, by furnishing technical advice, and laboratory space for three workers.

F. IT IS MUTUALLY AGREED that:

(1) This memorandum may be terminated at any time by any one of the parties by written notice, and may be amended by written mutual agreement;

(2) The cooperative plan of work in this memorandum will be followed as being the best method of control of white-pine blister rust in California;

(3) All official records and reports of work performed under this agreement shall be open to inspection by any or all parties to this agreement, that all findings of blister rust made by any party to this agreement shall be promptly reported to all other parties to this agreement, and that all specimens collected by any party to this agreement which are suspected of being infected with blister rust shall be submitted promptly to the Bureau of Plant Industry for final determination;

(4) The results of the cooperative work may be published jointly, or upon mutual agreement by either cooperating party, due credit being given to the cooperating agencies. All manuscripts therefor shall be criticised by the cooperating parties before publication; and all form letters, bulletins and any other circulars to be mailed in penalty envelopes shall be submitted in manuscript form for approval by the Bureau of Plant Industry before being printed or distributed;

(5) Obligations by the Bureau of Plant Industry are contingent upon appropriations being made therefor by Congress; and no funds of the United States shall be expended in compensation for host plants destroyed in control work;

(6) For the Fiscal Year 1931, the Bureau of Plant Industry shall contribute in value approximately $27,700 to the support of this cooperative work, the California Department of Agriculture approximately $9,000, the California State Board of Forestry approximately $3,000, the College of Agriculture, University of California approximately $10,000, and the Department of Botany, University of California shall contribute in value approximately $3,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence or amendments.

Date:	Signature:
6/25/30	(s) G. H. Hecke Director, California Department of Agriculture
6/5/30	(s) M. B. Pratt State Forester, California State Board of Forestry
June 11, 1930	(s) C. B. Hutchinson Dean, College of Agriculture, University of California
June 12, 1930	(s) W. A. Setchell Department of Botany, University of California
July 9, 1930	(s) Wm. A. Taylor Chief, Bureau of Plant Industry

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(6) For the fiscal year 1931, the Bureau of Plant Industry shall contribute in value approximately $27,700 to the support of this cooperative work, the California Department of Agriculture approximately $10,000, the California State Board of Forestry approximately $2,000, the College of Agriculture, University of California approximately $10,000, and the Department of Botany, University of California shall contribute in value approximately $4,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence or amendments.

Date:	Signature:
6/23/30	(s) G. H. Hecke Director, California Department of Agriculture
6/1/30	(s) M. B. Pratt State Forester, California State Board of Forestry
June 11, 1930	(s) C. B. Hutchison Dean, College of Agriculture, University of California
June 12, 1930	(s) T. H. Goodspeed Department of Botany, University of California
July 3, 1930	(s) Wm. A. Taylor Chief, Bureau of Plant Industry

BLISTER RUST ACTIVITIES IN CALIFORNIA, 1930

By
George A. Root,
Associate Pathologist

Reports on the work under way in California have been prepared by the several project leaders concerned. The subjects reported on by the leaders are as follows: Ribes Ecology by F. A. Patty; Control Reconnaissance by D. R. Miller and Experimental Ribes Eradication by W. V. Benedict. The account of the investigations of Ribicides in California is incorporated in H. R. Offord's special report.

BLACK CURRANT ERADICATION

The decrease in funds allotted to this project, on which ordinarily one or more well organized crews have been employed, meant a change in the usual procedure of work. The program, this year, called for the more active cooperation of the county agricultural commissioners and their inspectors who as their time permitted were to locate and destroy black currant bushes in their counties or districts as best they could. Reports from the commissioners of Orange, San Bernardino, Riverside, Imperial, San Diego and Los Angeles counties state that no bushes have been found. The writer spent some time in each county, scouting in what seemed to be likely sections, but no plantings were found. It might seem that the apparent absence of black currants was due to the method of work, yet the general area comprising these counties is one not conducive to the growth of currants. This is evidenced by the lack of bushes found in contiguous counties, covered by the usual mode of scouting.

The year brings to a close the black currant eradication project. Constant follow-up work will be necessary. Occasional plantings are found from time to time. One planting of six bushes was located in San Mateo County, one of two bushes in Sacramento County and one of nine in Riverside County. A re-inspection of a planting of 14 bushes in Siskiyou County found in 19[illegible], revealed one bush this year.

NURSERY INSPECTION AND QUARANTINE MATTERS

The inspection of nurseries was largely carried on through the Office of the Superintendent of Nursery Service of the State Department of Agriculture. A close watch is being kept of blister rust hosts. New nurseries are constantly being established and the status of these is carefully listed. Certain nurseries which had 5-needled pines in the past were visited by the writer this year, but in each instance the trees had been disposed of and the growing of the same discontinued. This corroborated the idea that during the past five or six years, the private nursery carrying general stock had abandoned 5-needled pines.

BLISTER RUST ACTIVITIES IN CALIFORNIA, 1936

by

George A. Root,

Associate Pathologist

Reports on the work under way in California have been prepared by the several project leaders concerned. The subjects reported on by the leaders are as follows: Ribes Ecology by J. L. Mielke; Control requirements by D. R. Miller and Experimental Ribes Eradication by W. V. Benedict. The account of the investigations of Ribicides in California is incorporated in C. R. Offord's special report.

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The year brings to a close the black currant eradication project. Constant follow-up work will be necessary. Occasional plantings are found from time to time. One planting of six bushes was located in San Mateo County, one of two bushes in Sacramento County and one of nine in Riverside County. A re-inspection of a planting of 18 bushes in Placer County found in 1934, revealed one this year.

NURSERY INSPECTION AND QUARANTINE ENFORCEMENT

The inspection of nurseries was largely carried on through the office of the Superintendent of Nursery Service of the State Department of Agriculture. A close watch is being kept of Ribes plant lists. New nurseries are constantly being established and the status of these is carefully checked. Certain nurseries which had R. nigrum plants in the past were visited by the writer this year, but in each instance the trees had been disposed of and the growing of the same discontinued. This corroborated the idea that during the past five or six years, the private nursery carrying general stock had abandoned handling of ribes.

The state quarantine stations, particularly on the northern border, have continuously intercepted contraband blister rust material. Some of this has come from infected areas of several states. No infected material has been found, however.

THE SANITATION OF NURSERIES

In order to meet the conditions of the quarantine regulations under which white pines may be shipped from an infected state, it will be necessary to provide adequate protection against blister rust to the several California nurseries growing 5-needled pines. Although this state is officially considered non-infected, the rust may be discovered here in the near future. Nursery sanitation measures will permit the shipping of 5-needled pines from the state when California is classed as an infected state. Even though no pines are to be shipped interstate it is felt that the pines grown in these nurseries for planting within the state should be protected. For these reasons a study of the situation was begun this year.

A. The Eddy Tree Breeding Station:

This institution is situated near Placerville in El Dorado County in the foothills of the Sierra Nevada Range. It has approximately 1500 5-needled pines in the nursery beds, together with others in the arboretum which is an important adjunct to the institution. It has shipped pines all over the country and is desirous of continuing this program. The writer, aided by Benedict and Miller, presented an estimate of cost for the removal of Ribes within the prescribed 1500 foot zone. It is possible that this work will be started in 1931, the first of its kind in California.

B. Nursery of the Union Lumber Company.

This firm located at Fort Bragg, Mendocino County, is in a redwood section and grows primarily redwood trees. However, the nursery comprises numerous species of trees and shrubs including one bed of sugar pine. These are being grown in an experimental way and are shipped to all parts of the country when occasion demands. The forester of the company is desirous of affording protection to these pines, but is not in a position to allocate special funds for eradicative work. Should this take place at some future time, nursery labor will undoubtedly be employed under supervision of the forester, who is well acquainted with Ribes and our method of work. To eradicate within the prescribed zone will not be difficult. Perhaps a year or two years can elapse before protection will be necessary. This will depend of course upon the rapidity with which the rust may reach this section.

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a. The Eddy Tree Breeding Station:

This institution is situated near Placerville in El Dorado County in the foothills of the Sierra Nevada Range. It has approximately 1500 5-needled pines in the nursery beds, together with others in the arboretum which is so important adjunct to the institution. It has shipped pines all over the country and is desirous of continuing this program. The writer, aided by Superintendent [illegible], presented an estimate of cost for the removal of Ribes within the prescribed 1500 foot zone. It is possible that this work will be started in 1933, the first of its kind in California.

b. Nursery of the Union Lumber Company:

This firm located at Fort Bragg, Mendocino County, is a redwood section and grows primarily redwood trees. However, the nursery sometimes carries a number of trees and shrubs including one lot of sugar pine. These are being grown in an experimental way and are shipped to all parts of the country when occasion demands. The forester of the company is desirous of affording protection to these pines, but is not in a position to allocate special funds for eradicative work. Should this take place at some future time, nursery labor will undoubtedly be employed under supervision of the forester, who is well acquainted with Ribes and the methods of work. No eradication within the prescribed zone will now be attempted. Perhaps a year or two years will elapse before protection will be necessary. This will depend of course upon the rapidity with which the rust may reach this section.

C. Nursery of the U. S. Forest Service:

The Susanville Nursery, established a few years ago, is located in Susanville in Lassen County. It comprises about seven acres on the outskirts of the city and will furnish trees for reforestation purposes for the Modoc, Lassen and Plumas Forests. With the exception of one bed of sugar pine, the greater majority of the trees are Yellow and Jeffrey pines. With sugar pine being grown here as an experiment there is some doubt as to whether the propagation of this species will continue in the future.

The 1500 foot zone around this nursery takes in a considerable stretch of open country, with some R. roezli, together with a residential section with but few cultivated Ribes plantings. One of these plantings comprises nearly 100 currants and gooseberries from which some revenue is derived from the sale of fruit. Should eradication be decided upon at some future date, this difficulty can probably be adjusted. There is no necessity for immediate action concerning the sanitation of this nursery.

D. Nursery of the Fruit Growers Supply Company:

This is located not far from the Federal Nursery, and comprises but a small plot of ground. Yellow and Jeffrey pines are being grown almost exclusively with one bed of sugar pine. The same attitude is taken regarding sugar pine, and it would not be surprising if this species would be abandoned in so far as the propagation is concerned. The eradication of the prescribed zone would involve no great difficulty. It largely embraces a residential section with an area cut by a river the bed of which would probably contain a considerable number of Ribes.

E. and F. Nurseries of the Pacific Lumber Company and the Clover Valley Lumber Company:

These are respectively located in Humboldt and Sierra counties, the former in the redwood region and the latter in the pine region.

The Pacific Lumber Company, like the Union Lumber Company, is primarily interested in redwoods, and the small group of sugar pine now in the nursery will be disposed of in the event of the presence of the rust in that section. The Clover Valley Lumber Company attempted to raise sugar pine, but poor results led them to discontinue this species.

G. and H. The Devil's Canyon Nursery and the Nursery of Los Angeles County:

The Devil's Canyon Nursery belongs to the California Forest Experiment Station and is located about 12 miles from San Bernardino. Its existence is justified by an attempt to grow certain species of conifers to reforest some of the denuded and brush-covered slopes of that southern region, mainly as an aid to watershed protection. Just a few

sugar pines are being grown, but little or no hope is extended for this species as a primary one for this type of planting. Coulter pine seems to be one of the most promising.

The Los Angeles County Nursery is situated on the Mt. Wilson Toll Road east of Altadena, and provides stock for planting out on certain county areas, also as an aid to watershed protection. There is one bed of sugar pine grown only for experimental purposes. None are to be planted out. This nursery like the foregoing one, does not warrant blister rust protection considering the present status which 5-needled pines hold in that southern region.

It must be said that the propagation of sugar pine with subsequent planting as a reforestation measure hangs in the balance. No private forestry nurseries will grow sugar pine on a large scale in the light of present day results, and there is a question whether enough will be grown to warrant the cost and trouble involved in establishing protective zones except in a few cases.

SCOUTING FOR THE DISEASE

The presence of the rust on Ribes in southwestern Oregon in 1929, less than 50 miles from the California line, led one to believe it would be found in this state in 1930. With this thought in mind an intensive survey was made in Del Norte, Siskiyou and a part of Humboldt County during September by four men with two autos. The failure to find the rust at the two Oregon infection points of 1929, or even in the surrounding territory, lessened the possibility of finding it south of the Oregon line. No signs of the rust were found.

Most of the scouting was done along the Smith River and Klamath River drainages. The work in the coast region was confined to inspections of R. bracteosum in certain localities where the bushes were not screened but well in the open. This seemed the best course to pursue with the situation as it stood.

TABLE NO. 1

INSPECTION POINTS IN HUMBOLDT COUNTY, CALIFORNIA

Location	Species Examined	No. Bushes	*Pine Ass'n.	Remarks	Inspectors	Date
Several points along Redwood Creek, T.9N., R.2E., Sec. 6 and in T. 10N., R.2E., Sec. 30 and 32.	R. bracteosum	45	Very poor	Ribes occur in patches on most any side stream	Benedict and Harris	9/19/30
Along road E. side of Klamath River, N. of Martin's Ferry, T. 10N., R.4E.; Sec. 18 and 19	R. cruentum R. sanguineum	75 15	"	Apparently no R. bracteosum	"	9/20/30
S. of Weitchpec on Bull Creek T. 9N., R.4E., Sec. 14	R. bracteosum	5	Poor	---	"	"
S. of Weitchpec on Norton Creek, T. 9N., R.4E., Sec. 25	R. cruentum	25	"	Ribes along road	"	"
On Whathern Creek, W. of Orleans T. 10N., R. 5E., Sec. 2.	R.klamathense	10	"	Sugar pine along ridges	"	"
Near Orleans up Camp Creek T. 11N., R.5E., Sec. 22.	R.bracteosum	10	"	Ribes scattering	"	9/21/30
Near Jct. Camp Creek and Highway, T. 11N., R.5E., Sec. 35.	R. cruentum	50	"	---	"	"
Harris Ranch, near Orleans T. 11N., R.5E., Sec. 31	R. cruentum	25	"	---	"	"

*By "Pine Association" is meant the distance from Ribes to pines according to the following legend:

Excellent - Pines within 100 feet.
Very good - Pines 101 to 250 feet distant.
Good - Pines 251 to 500 feet distant.
Fair - Pines 501 to 1,000 feet distant.
Poor - Pines 1,001 to 1,500 feet distant.
Very poor - Pines over 1,500 feet distant.

TABLE NO. 2

INSPECTION POINTS IN DEL NORTE COUNTY, CALIFORNIA

Location	Species Examined	No. Bushes	Pine Association*	Remarks	Inspectors	Date
Along small creek, just in MacBeth Ranch, E. of Turwar Creek, T. 13 N., R. 2 E., Sec. 18.	R. bracteosum	50	Very Poor	---	Root Patty	9/20/30
On island in Turwar Creek - 200 yds. N. of bridge, T. 13 N., R. 2 E., Sec. 18.	R. divaricatum	20	Very Poor	Exposed	Patty	9/20/30
About 1/4 mi. W. of highway on road to Requa - near white house. Down creek, T. 13 N., R. 1 E., Sec. 4.	R. bracteosum	40	Very Poor	Very good point	Root Patty	9/20/30
Wilson Creek - both sides of Redwood Highway - more east side T. 14 N., R. 1 E., Sec. 18.	R. bracteosum	100	Very Poor	Very good point	Root Patty	9/20/30
Creek at Endert's Beach - both sides of highway - more on east side T. 15 N., R. 1 W., Sec. 2.	R. bracteosum R. sanguineum	75 5	Very Poor	---	Root Patty	9/20/30
Gilbert Creek - both sides of highway. N. W. corner of county. T. 18 N., R. 1 W., Sec. 5.	R. bracteosum	100	Very Poor	Very good point	Root Goodding	7/13/30 9/19/30
Along creek, tributary to Rowdy Creek about 1-1/2 mi. E. of town of Smith River. N. side of road. T. 18 N., R. 1 W., Sec. 24.	R. bracteosum	30	Very Poor	Exposed	Patty Root	9/26/30
About 2 mi. N. of Hionchi Bridge on road to Smith River. 1st wooden bridge - both sides stream. T. 17 N., R. 1 E., Sec. 29.	R. bracteosum	40	Very Poor	---	Root Patty	9/26/30
About 3/4 mi. W. Hionchi Bridge, Redwood Highway. Swamp. T. 16 N., R. 1 E., Sec. 5.	R. bracteosum	60	Very Poor	Exposed	Goodding	9/20/30
About 1-1/2 mi. E. of bridge crossing Rowdy Creek along old Grant's Pass road, side stream. T. 18 N., R. 1 E., Sec. 29.	R. bracteosum	5	Very Poor	---	Root Patty	9/27/30
2-1/2 mi. E. of Gasquet along Grant's Pass Highway. Both sides road. T. 17 N., R. 2 E., Sec. 22.	R. sanguineum	10	Good	Considerable western white pine. Inspected 100 trees.	Root Patty	9/28/30
Up Patrick Creek, back of Tavern on Grant's Pass Highway. T. 17 N., R. 3 E., Sec. 8.	R. cruentum	50	Very Good	Scattered white pine.	Root Patty	9/28/30
About 2 mi. above last concrete bridge going N. toward California-Oregon line. T. 18 N., R. 4 E., Sec. 21.	R. bracteosum	30	Very Good	R. bracteosum along river near highway.	Root Patty	9/28/30
About 1 mi. S. Oregon line. Not far from Siskiyou Restaurant and camp ground along creek. T. 18 N., R. 4 E., Sec. 2.	R. bracteosum	10	Good	R. bracteosum well exposed.	Root Patty	9/28/30

*By "Pine Association" is meant the distance from Ribes to pines according to the following legend:

Excellent - Pines within 100 feet.

Very good - Pines 101 to 250 feet distant.

Good - Pines 251 to 500 feet distant.

Fair - Pines 501 to 1,000 feet distant.

Poor - Pines 1,001 to 1,500 feet distant.

Very poor - Pines over 1,500 feet distant.

Annual Report 1930
G. A. Root

TABLE NO. 3

INSPECTION POINTS IN SISKIYOU COUNTY, CALIFORNIA

Location	Species Examined	No. Bushes	Pine Association*	Remarks	Inspectors	Date
Butler Creek - tributary of Salmon River - near highway, T. 11 N., R. 7 E., Sec. 20.	R. cruentum	30	Fair	Sugar pine on slopes near by	Benedict Harris	9/21/30
Lewis Creek - tributary of Salmon River near highway, T. 11 N., R. 7 E., Sec. 28.	R. cruentum	10	Fair	Sugar pine on slopes near by	Benedict Harris	9/21/30
Sauerkraut Creek, tributary of Salmon River - near highway. T. 11 N., R. 7 E., Sec. 34.	R. cruentum	10	Fair	Sugar pine on slopes near by	Benedict Harris	9/21/30
Rogers Creek, near highway above Orleans. T. 12 N., R. 6 E., Sec. 10.	R. cruentum	10	Fair	---	Benedict Harris	9/22/30
Irving Creek - near highway, T. 12 N., R. 5 E., Sec. 3.	R. cruentum	5	Good	---	Benedict Harris	9/22/30
Swillup Creek - near highway, T. 14 N., R. 5 E., Sec. 10.	R. cruentum	10	Poor	---	Benedict Harris	9/22/30
Clear Creek - Pick-aw-ish Camp Ground near highway, T. 15 N., R. 7 E., Sec. 7.	R. cruentum	25	Very Good	Sugar pine reproduction up Elk Creek.	Benedict Harris	9/22/30
Elk Creek - near Happy Camp, T. 16 N., R. 7 E., Sec. 15.	R. cruentum R. klamathense	15 15	Good	Sugar pine reproduction.	Benedict Harris	9/22/30
Several points along Indian Creek. No specific locations given.	R. bracteosum	10	Good	---	Benedict Harris	9/23/30
At points along Indian Creek, T. 17 N., R. 11 W., Secs. 9 and 15.	R. cruentum	35	Good	Sugar pine reproduction in flats near creek.	Benedict Harris	9/23/30
In T. 18 N., R. 6 E., Secs. 8 and 9 above sugar pine range on Siskiyou summit. Up Indian Creek.	R. lacustre R. sanguineum R. binominatum R. marshallii R. lobbii	10 15 15 7 20	Poor	Good stand of sugar pine on Poker Flat.	Benedict Harris	9/23/30
Up Seiad River about 6 mi. T. 47 N., R. 11 W., Sec. 29. Mt. Diablo Mer.	R. cruentum R. lobbii	10 25	Good	Scattered sugar pine chiefly reproduction along stream.	Benedict Harris	9/23/30
At Mill Creek near Scott Bar. T. 45 N., R. 10 W., Sec. 14.	R. cruentum R. lobbii	30 20	Good	Sugar pine along slopes.	Benedict Harris	9/24/30
Up Horse Creek - West Fork. T. 47 N., R. 10 W., into R. 11 W. and to summit of mountains.	R. viscosissimum R. lobbii R. cruentum R. lacustre	10 15 45 10	Fair	Ribes not abundant in sugar pine type.	Benedict Harris	9/27/30
West of Hilt along Hungry Creek. T. 48 N., R. 8 W., Sec. 9 and 10.	R. lacustre R. klamathense R. cruentum R. lobbii R. sanguineum	10 25 45 10 10	Very good	Ribes numerous along streams and old burns.	Benedict Harris	9/25/30
Vicinity Copco Lake. T. 47 N., R. 4 W., Secs. 2 and 4 along highway.	R. klamathense	20	Fair	Ribes along streams.	Benedict Harris	9/26/30
Near Beswick, along streams. T. 48 N., R. 3 W.	R. klamathense R. velutinum	10 20	Fair	R. klamathense along streams. R. velutinum on slopes.	Benedict Harris	9/26/30
Several points along Little Shasta River, T. 45 N., R. 3 W., Secs. 6 and 9. Near highway.	R. cereum R. klamathense	20 30	Good	Pines scattered	Benedict Harris	9/28/30

*By "Pine Association" is meant the distance from Ribes to pines according to the following legend:

Excellent - Pines within 100 feet.

Very good - Pines 101 to 250 feet distant.

Good - Pines 251 to 500 feet distant.

Fair - Pines 501 to 1,000 feet distant.

Poor - Pines 1,001 to 1,500 feet distant.

Very poor - Pines over 1,500 feet distant.

On the Klamath National Forest, on which a great number of inspections were made, Benedict sums up the situation thus: "In general, Ribes are not abundant in sugar pine type. They are, however, numerous in patches above and below the altitudinal range of sugar pine. R. cruentum was the most abundant and widely distributed Ribes species noted. R. lacustre, R. sanguineum and R. lobbii were also numerous. Very little typical Ribes stream type was noted. Ribes generally are more abundant along flats, roads and lower slopes above stream bed."

EDUCATIONAL WORK

The gradual termination of the black currant project, has obviously resulted in a less active educational campaign, particularly on this phase of the work. The trend of activities has been of a general nature and disseminated over the state as a whole.

A. Panel Exhibits.

The 5-panel exhibit which proved so satisfactory on the black currant work still retains a place of value as a nucleus for small fair exhibits. It occasionally fills a want when something is desired for a window display. One was placed in the window of the agricultural commissioner's office in Sonora for two weeks during the past summer.

B. Blister Rust Film.

Since the use of the old blister rust film has been abandoned as an educational feature, the thought of replacing it with a smaller film resolved itself into a "tryout" with a Cine'-Kodak. A camera was borrowed from a local firm and some "shots" taken of the California work. Considerable experience and development of technic are required before satisfactory pictures can be obtained. It is almost essential that the camera be in the hands of a professional photographer. It must be admitted that the use of this small film in the educational field is restricted. It may be that it will not fit into the general scheme of educational work now felt to be most essential. Only before small groups particularly interested in the prosecution of blister rust work does it seem to have possibilities. Further work is needed in this small film endeavor.

C. Exhibits.

Blister rust demonstrations were set up at the State Fair in Sacramento, the Nevada State Fair at Reno, the Del Norte County Fair in Crescent City and the California Flower Festival at San Leandro. Specimens in Riker mounts were given to the Santa Barbara Museum at Santa Barbara and the San Diego Museum in San Diego.

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EDUCATIONAL WORK

The gradual termination of the black currant project, has obviously resulted in a less active educational campaign, particularly in this phase of the work. The trend of activities has been of a general nature and disseminated over the state as a whole.

A. Panel Exhibits.

The 8-panel exhibit which proved so satisfactory on the black currant work still retains a place of value as a nucleus for small fair exhibits. It occasionally fills a want when something is desired for a window display. One was placed in the window of the agricultural commissioner's office in Eureka for ten weeks during the past summer.

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Under this heading may be included the educational sets which were left at seven colleges or universities and four normal schools or State Teachers' Colleges. There are several more of these institutions which will receive these sets in the near future. These sets have been received with considerable enthusiasm and interest.

D. Letters and Articles.

The presence of the rust in southwestern Oregon at the end of 1929 was of sufficient importance and interest to inform several groups directly or indirectly connected with blister rust control. Form letters were sent to the rangers of the seven northern National Forests through their respective supervisors. The letter took the following form:

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
Cooperating with
State Department of Agriculture
State Board of Forestry
and
College of Agriculture, University of California

To the Ranger:

The presence of the white pine blister rust in southwestern Oregon less than 50 miles from the California line makes it a potential menace to the sugar pine of California. This point in Oregon is over 100 miles farther south than the last known infection. It is not unlikely that the rust will make its appearance in this state this year. Fifty miles is not a long jump for this disease to make.

Considerable scouting will be done in northern California this season by the Office of Blister Rust Control. You can materially aid by keeping a close watch on currants, gooseberries and five-needled pines in your district. The rust appears on the pines in the spring and on currant and gooseberry leaves in the late summer or early fall.

Blister rust literature is being sent you, together with specimens, so that you may more easily identify suspicious material. Notify your supervisor and send in specimens if you suspect this disease. You may be the first to find it in California.

Thanking you for your cooperation, I am

Very respectfully yours,

(s) G. A. Root
Assistant Pathologist

[illegible] Exhibits

The [illegible] [illegible] [illegible]
current work which includes a place [illegible]
[illegible]. It [illegible]
window display. One was placed in [illegible]
[illegible]

A letter was sent to the Farm Advisors of the state, telling of the status of the rust.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY

Cooperating with
State Department of Agriculture
State Board of Forestry
and
College of Agriculture, University of California

THE STATUS OF THE WHITE PINE BLISTER RUST AT THE END OF 1929.

The year of 1929 was marked with one or more important features relative to the spread of disease. Perhaps the most significant of these was the discovery of the rust on wild currants in Curry County, Oregon. Two infections were found - seven and fifteen miles respectively south of Port Orford. This represents a substantial expansion in the southward spread of the disease on the coast, being less than fifty miles from the Oregon-California line. The southernmost infection previous to this was fully one hundred miles to the north.

In the Cascade region the rust is gradually spreading southward. Currant infection was found just northwest of Bend, a point about one hundred miles south of the Columbia River. Pine infection is thoroughly established in the Mt. Hood region.

The coast infections lead one to believe that the time is not far distant when the rust will be found in California - perhaps this year. Scouting for the disease in Del Norte County this year revealed no signs of the rust. Thorough search will be made next year in that territory contiguous to Oregon. The stage has been reached where the California sugar pine will be the next of commercial white pines to become attacked by this disease. We already have the eastern white pine and Idaho or western white pine infected in certain areas of their natural range.

The above information is left with you so you may answer certain questions which may arise concerning this disease. In your travels throughout your county, the opportunity may arise where you can help in this forest conservation measure.

Thanking you for your past cooperation, I am

Very respectfully yours,

(s)G. A. Root
State Leader in Blister Rust Control

An item of a similar nature was incorporated in a Confidential News Letter of the State Department of Agriculture which reaches all County Agricultural Commissioners and Inspectors.

An article, "The Status of the White Pine Blister Rust in the West," was put in the July issue of the Monthly Bulletin of the State Department of Agriculture. One newspaper release concerning the status of the rust this year reached a chain of one hundred or more papers throughout the state.

E. Talks.

Two talks were given during this year, one on blister rust before a group of Agricultural Commissioners at Strawberry, the scene of the current year's work, and another one on forestry conservation broadcast from station K.Q.W., at Sacramento, under the auspices of the State Department of Agriculture.

RECOMMENDATIONS

In general, the different phases of blister rust work which have been carried on during 1930 should be continued in 1931. Constant "follow-up" work on the black currant situation is in order. Intensive scouting, particularly in the northern part of the state, should take the form of a well organized program. The proximity of the rust to the two Government nurseries in Idaho and Washington respectively should bring to mind the necessity of the sanitation of nurseries in California, private or otherwise, before the rust is near them. Chemical investigations should be continued, as well as ecological studies. Some experimental re-eradication should be done, and possibly some work on new areas in some of the National Forests. Protection of one or more of the National Parks should receive consideration. The educational work, besides dealing directly with blister rust, should sound a note of general conservation of forest resources with some stress laid upon the value of sugar pine.

An expression of thanks is due the various cooperative agencies and those who have contributed a whole-hearted cooperation in the conduct of the work during 1930.

RIBES ECOLOGY, CALIFORNIA

By
F. A. Patty
Assistant Pathologist

INTRODUCTION

Studies upon the ecology of Ribes were begun in the commercial sugar pine regions of the Stanislaus National Forest, California in 1928 and were continued on the same forest during the summers of 1929 and 1930. In addition, during 1930, the studies were extended to the Sierra National Forest, which is to the south of the Stanislaus National Forest.

PURPOSE

The purpose of a Ribes ecology project in California is to make a comprehensive study of the Ribes of the sugar pine region to determine the factors governing their occurrence and the application of such information in preparing a program of blister rust control for the region.

The main objectives of the studies undertaken will be to answer the following questions concerning the principal Ribes species of the region:

1. Does Ribes seed remain in soil or duff under storage conditions?

2. Does old stored seed or fairly fresh seed produce the young plants?

3. How long before the young plants begin to produce fruit?

4. How soon after logging do new plants appear?

5. Do birds and rodents play an important role in the distribution of Ribes seed?

6. If Ribes seeds are present in the soil of mature timber, in what part of the duff are they located?

7. Does the duff act as a refrigerating agent in preventing the germination of Ribes seed until a disturbance breaks the refrigerating effect?

8. What is the effect on the number of new plants, of removing the veteran Ribes just prior to logging?

9. What is the effect of fire, clear cutting and partial cutting on the production of new plants?

RIBES ECOLOGY, CALIFORNIA

by

J. A. Pelly
Assistant Pathologist

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9. What is the effect of fire, clear cutting and partial cutting on the production of new plants?

10. How long do new Ribes continue to appear on an area following logging? How fast do they grow?

11. Are conditions on dry sites favorable for germination and survival of Ribes?

12. Do bushes in the mature stands of timber bear good crops of seeds?

This information would assist the eradication forces to plan a systematic Ribes eradication program for an area. Definite knowledge of all or a number of these points would provide partial information as to the best time to perform eradication with respect to logging, before or after logging and how long before or after; and when subsequent eradications should be made.

The information might be of value to the forester in shaping his management plan. If the costs of permanently suppressing Ribes on a partially cut area were economically feasible, and on the other hand if the suppression costs were found to be prohibitive on a clear-cut area, the forester would probably practice partial cutting if he planned to continue on a sustained yield basis.

METHODS USED

The studies and plots are grouped under two main heads, namely, permanent and temporary. The methods which have been used in the various studies vary somewhat, so brief description will be made for each one as it is taken up in this report.

The following is a list of the studies now in progress:

Permanent Plots and Studies

A. The effect of different types of logging on Ribes regeneration.

B. The rate of Ribes re-establishment in sugar pine-yellow pine and sugar pine-fir types following logging.

C. The rate of Ribes re-establishment on stream types following logging.

D. Studies to determine the year in which the greatest number of Ribes appear following an initial eradication.

E. The effect of the removal of various parts of the Ribes plant on regeneration.

F. The effect of various soil disturbances on Ribes germination for different exposures.

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F. The effect of various soil disturbances on Ribes germination for different exposures.

G. Ribes growth studies on the Cow Creek plot.

H. The influence of moisture on the germination and survival of Ribes on dry sites.

Temporary Studies

A. Duff analysis for seed storage.

B. Strip transect studies, Sierra National Forest, 1930.

RESULTS PERMANENT PLOTS AND STUDIES

A. The Effect of Different Types of Logging on Ribes Regeneration.

1. Purpose of study. The purpose of this study is to determine the rate of establishment of Ribes on areas where Forest Service cutting methods have been practiced for the past twenty years.

2. Methods used. In 1910 two 20-acre plots were established by the Forest Service and cut under their supervision. The Ribes were eradicated in this locality in 1926, although no record was kept of the number of bushes or the feet of live stem removed for the plots. However, there is a record of the number of Ribes per acre which were found on the block into which these two plots fall.

The residual stand of mature timber was removed from Plot No. 1 in 1928, leaving only a very few mature trees, the reproduction, and most of the brush. Exceptional care was exercised in logging not to disturb the reproduction. As a result, a minimum amount of ground disturbance was created.

Plot No. 2 was not logged the second time. Conditions on the two plots are quite comparable. However, a small creek runs through the end of Plot No. 2.

Both plots are located in sugar pine-yellow pine type on gentle slopes which are well covered with brush.

During the latter part of the summer of 1930, both of these plots were carefully checked, and data weretaken on the number of Ribes, feet of live stem, and the number of fruits present at the time of checking.

TABLE NO. 1

RIBES ESTABLISHMENT ON FOREST SERVICE CUTTING AREAS, SP-YP TYPE

	Plot No. 1				Plot No. 2					
	Ribes roezli			R. nev.	Ribes roezli			Ribes nevadense		
Age of Bushes	Number of Bushes	Feet Live Stem	Number of Fruits		Number of Bushes	Feet Live Stem	Number of Fruits	Number of Bushes	Feet Live Stem	Number of Fruits
Old bushes	27.0	1,025.0	174.0	-	56.0	1,064.0	131.0	29.0	237.0	-
2 years	1.0	8.0	-	-	-	-	-	1.0	3.0	-
1 year	-	-	-	-	2.0	1.0	-	2.0	2.0	-
Seedling	-	-	-	-	-	-	-	17.0	-	-
Totals	28.0	1,033.0	174.0	-	58.0	1,065.0	131.0	49.0	242.0	-
Average Per Acre	1.4	51.6	8.7	-	2.9	53.2	6.5	2.4	12.1	-

Plot No. 1 - Cut over in 1910.
Ribes eradicated in 1926.
Residual timber cut in 1928.
Ribes checked in 1930.

Plot No. 2 - Cut over in 1910.
Ribes eradicated in 1926.
Ribes checked in 1930.

3. Results obtained. Table No. 1 shows the results of the checks made on these plots in 1930. Very few Ribes have germinated and survived on the plots except in Plot No. 2 where R. nevadense is coming in along the stream.

The probable reason the plots are not restocking with Ribes is that in 1926 most of the fruiting bushes were eradicated and on dry sites there are very few seeds stored in the soil.

B. The Rate of Ribes Re-establishment in Sugar Pine-Yellow Pine and Sugar Pine-Fir Types Following Logging.

1. Purpose of study. The purpose of this study is to obtain data on Ribes re-establishment in sugar pine-yellow pine and sugar pine-fir types after logging, and to study the influence of Ribes eradication before and after logging on Ribes regeneration.

2. Methods used. Previous to logging, two adjacent 5-acre plots were laid out in sugar pine-fir timber type and two in sugar pine-yellow pine timber type. Ribes were eradicated on one plot in each type and on the other plots a census was made of the number of bushes but they were not eradicated. The plots were logged early in July, 1929. During the latter part of the 1930 field season the four plots were re-checked and all remaining bushes removed.

TABLE NO. 2

THE RATE OF RIBES RE-ESTABLISHMENT IN SUGAR PINE-YELLOW PINE AND SUGAR PINE-FIR TYPES FOLLOWING LOGGING

	Plot No. 1			Plot No. 2			Plot No. 3			Plot No. 4		
	Sugar Pine-Fir Ribes Not Eradicated			Sugar Pine-Fir Ribes Eradicated			Sugar Pine-Yellow Pine Ribes Eradicated			Sugar Pine-Yellow Pine Ribes Not Eradicated		
	Number Bushes Per Acre	Feet Live Stem Per Acre	Number Fruits Per Acre	Number Bushes Per Acre	Feet Live Stem Per Acre	Number Fruits Per Acre	Number Bushes Per Acre	Feet Live Stem Per Acre	Number Fruits Per Acre	Number Bushes Per Acre	Feet Live Stem Per Acre	Number Fruits Per Acre
Bushes Found Before Logging	42	342	126	56	814	152	20	251	24	32	310	58
Bushes Found After Logging	16*	147	56	5*	16	10	6	84	-	26	216	53

All the bushes listed in this table (except 2) were present before logging.
*One of the bushes was a 1932 seedling.

3. Results obtained. Table No. 2 gives a summary of the Ribes conditions as they existed on the plots in 1929 previous to logging, and in 1930, one year after logging. The table brings out the point that only two new bushes appeared on the four plots in 1929 and 1930 in spite of the fact that plots No. 1 and 2 represent good potential Ribes sites. These data also show that a fair number of bushes per acre are left on an area after logging and that many of these old bushes are capable of producing fruit the year following the removal of the timber providing other conditions are favorable. Logging on these plots was carried on under the supervision of the Forest Service; hence, their standard cutting regulations were used.

The bushes which are shown as present after logging on plots 2 and 3 (from which the Ribes were eradicated) represent the ones that were missed during eradication.

C. The Rate of Ribes Re-establishment in Stream Type Following Logging.

1. Purpose of study. The purpose of this study is to determine the rate of Ribes re-establishment in stream type after logging.

2. Methods used. The plot was laid out in the spring of 1929 in uncut stream type. No check was made of the Ribes, although it was estimated at that time that they averaged about 75 per acre. It was not possible to take a census of the Ribes on the plot because the falling crews had begun work a few days after the preliminary check had been made. The old bushes were not bearing many fruits because a heavy late spring frost had killed most of the flowers and young shoots. Only a few bushes growing in protected places bore any fruits. During the latter part of August, 1930 this plot was carefully checked, data recorded and all of the bushes were removed.

TABLE NO. 3

REGENERATION OF RIBES IN STREAM TYPE

	Ribes Per Acre				Feet Live Stem Per Acre			
Ribes Species	Old Bushes	1929 Bushes	1930 Bushes	Total	Old Bushes	1929 Bushes	1930 Bushes	Total
R. roezli	14	7	230	251	211	23	57	291
R. nevadense	6	6	365	377	44	7	16	67
R. cereum	1	0	7	8	3	0	3	6
Totals	21	13	602	636	258	30	76	364

This area was logged in 1929. Approximately 75 Ribes per acre were present before logging.

3. Results obtained. Table No. 3 shows the number of bushes and feet of live stem found on the plot when the check was made. A few Ribes germinated in 1929, the year in which the area was logged, but a much larger number appeared in 1930. These data really have a great deal more significance when they are compared to the data in Table No. 2. A comparison of these tables indicates that stream type begins to produce an abundance of Ribes the year following logging, while sugar pine-fir and sugar pine-yellow pine type do not do so. However, more evidence will have to be obtained from other areas before a final conclusion can be made. Additional checks will be made every year to obtain a comparison on the rate of the regeneration of Ribes on the sugar pine-yellow pine, sugar pine-fir and stream types.

D. A Study to Determine the Year in Which the Greatest Number of Ribes Appear Following Eradication.

1. Purpose of study. This study was begun early in September, 1930 after the Ribes fruits had ripened, to determine how many years elapse after an eradication before the year of maximum germination is reached. Over a period of four or five years there is usually one season in which a large number of seeds germinate. This year is referred to as the "year of maximum germination". This particular site was selected because it was known that there were thousands of Ribes seed present on the plot. This was also considered an excellent site for Ribes due to the soil, moisture and shade conditions.

2. Methods used. On an area which was cut over in 1925, there were found to be about 60 acres coming back to R. roezli, R. nevadense, R. cereum and R. viscosissimum. This area averaged approximately 1,000 Ribes per acre with parts of it running as high as 1,500 per acre. Over 99 per cent of the Ribes were R. roezli bushes. A small plot of 1.6 acres where the concentration was the greatest was selected for this study.

The bushes were grubbed out and left on the ground where they were dug. The force of the grub hoe striking the bushes caused most of the ripened fruits to fall off under the bushes. Data were taken on the number and species of bushes, feet of live stem, and the number of fruits. Undoubtedly the results of the study will be influenced a little by Ribes seeds which may be transported into the plot from surrounding areas. Sufficient numbers will hardly be carried in, however, to affect the year of maximum germination because of the enormous number of seed already present.

3. Results obtained. The study has not been completed but is presented merely to show what a tremendous number of seeds may be produced by R. roezli under optimum conditions during a favorable seed year.

A total of 1,451 *R. roezli*, 23 *R. nevadense*, 1 *R. cereum* and 1 *R. viscosissimum* bushes were removed from the 1.6-acre plot. The *R. roezli* bushes contained 35,620 feet of live stem and 37,815 fruits. The 25 other Ribes were not producing fruit. It is estimated that the 1,451 *R. roezli* bushes produced 1,510,000 seeds in 1931. This estimate was obtained by multiplying the number of fruits by the figure 40 which proved to be the average number of seeds per fruit for 2,000 *R. roezli* fruits which were collected in the vicinity.

B. The Effect on Regeneration of the Removal of Various Parts of the Ribes Plant

1. *Purpose of study*. This study was started to determine the regenerative ability of *R. roezli*, (1) when aerial parts of the bush and crown are removed, (2) when the aerial portions only are removed, and (3) to ascertain the number of years necessary for the plant to again bear fruit.

2. *Methods used*. Bushes which are usually grouped quite closely together in sets of four were treated in the following manner: (1) the aerial portion was removed and the crown left exposed; (2) the aerial portion was removed and the crown covered with four inches of soil; (3) the aerial portion and crown were removed and the roots left exposed; (4) the aerial portion and crown were removed and the roots covered with four inches of soil. All of the bushes were quite vigorous and were bearing fruit when the treatments were made. Some of them were fairly well shaded, while others were well in the open. This study was started in the summer of 1929 and checked in the fall of 1930. Twenty-eight groups of bushes with four bushes in each group were treated as described above. Two additional studies with 128 bushes in each study were started in 1930.

3. *Results obtained*. Table No. 5 gives the results of the study. Under the conditions of this experiment it appears that the roots of *R. roezli* are unable to sprout if they are left in the soil. The three bushes which had sprouted from roots probably had a little crown tissue left on them. When crowns are left in the ground more than 50 per cent of them live. Too much emphasis cannot be placed on the results of this experiment until additional data are obtained.

a total of 1,451 L. roezli, 33 L. [illegible], 1 L. [illegible] and 2 L. [illegible] bushes were removed from the 1.6-acre plot. The L. roezli bushes contained 24,000 feet of live stem and 37,815 fruits. the [illegible] which were not producing fruit. It is estimated that the 1,451 L. roezli bushes produced 1,512,000 seeds in 1951. This estimate was obtained by multiplying the number of fruits by the figure 40 which proved to be the average number of seeds per fruit for 4,000 L. roezli fruits which were collected in the vicinity.

C. The Effect on Regeneration of the Removal of Various Parts of the Ribes Plant

1. Purpose of study. This study was started to determine the regenerative ability of L. roezli, (1) when aerial parts of the bush and crown were removed, (2) when the aerial portions only are removed, and (3) to ascertain the number of years necessary for the plant to again bear fruit.

2. Methods used. Bushes which are usually grouped quite closely together in sets of four were treated in the following manner: (1) the aerial portion was removed and the crown left exposed; (2) the aerial portion was removed and the crown covered with four inches of soil; (3) the aerial portion and crown were removed and the roots left exposed; (4) the aerial portion and crown were removed and the roots covered with four inches of soil. All of the bushes were quite vigorous and were bearing fruit when the treatments were made. Some of them were fairly well shaded, while others were well in the open. This study was started in the summer of 1949 and checked in the fall of 1951. Twenty-eight groups of bushes with four bushes in each group were treated as described above. Two additional studies with 176 bushes in each study were started in 1950.

3. Results obtained. Table No. 2 gives the results of the study. Under the conditions of this experiment it appears that the roots of L. roezli are unable to sprout if they are left in the soil. The three bushes which had sprouted from roots probably had a little crown tissue left on them. When crowns are left in the ground more than 50 per cent of them live. Too much emphasis cannot be placed on the results of this experiment until additional data are obtained.

TABLE NO. 4

THE REGENERATIVE ABILITY OF ROOTS AND CROWNS OF R. ROEZLII

Treatment Applied*	Number of Bushes	Total Feet of Live Stem	Bushes Surviving	Feet of Live Stem Developed	Dead Bushes	Per Cent Mortality
A	28	2,085	16	267	12	42.8
B	28	1,460	20	372	8	28.6
C	28	1,715	2	10	26	92.9
D	28	1,730	1	12	27	96.4

*Legend.

A. Aerial portion cut off, crown exposed.
B. Aerial portion cut off, crown covered by 4" of soil.
C. Aerial portion and crown cut off, roots exposed.
D. Aerial portion and crown cut off, roots covered by 4" of soil.

F. The Effect of Various Soil Disturbances on Ribes Germination on Different Exposures.

During the last two years seven fenced and screened plots have been established on various representative exposures. Most of these plots are composed of 36 milacres and are fenced with barbed wire to exclude stock. Each plot is divided into 3 equal parts. One part is fenced with fly screen to exclude rodents and covered with cheesecloth to give a definite amount of shade; one part is fenced with fly screen to exclude rodents, and the third part is given no shade or protection from rodents. Various layers of duff were removed and the soil disturbed. (See page 223, 1929 annual report.) It is hoped by this method to determine in which part of the soil or duff Ribes seeds are stored. From 8 to 16 fruits were planted and staked in each milacre plot to determine if the various disturbances were favorable to Ribes germination.

As yet no data of significance have been obtained because the plots have not been established for a sufficient length of time.

G. Ribes Growth Studies on the Cow Creek Plot.

1. Purpose of study. The study was started in 1926 to find out the extent of Ribes invasion following logging and to study the Ribes bushes from year to year in relation to other plant life to determine the species of plant instrumental in shading out Ribes.

2. Methods used. An area of ten acres near Cow Creek which was cut in 1923 and fenced in 1927 has been under observation for the last three years. All of the bushes were located in 1928 and their ages determined. Each bush was staked with a 2-ft. stake to make rechecking easy. Ceanothus, bear clover, and other species of brush cover about three-fourths of the plot. During 1929 and 1930, the plot was rechecked, and each time a number of new bushes as well as many old ones which had been missed in the previous checks were located.

TABLE NO. 5

RIBES CONDITIONS ON THE COW CREEK PLOT

Year of Germination	Ribes Found Each Year		
	1928	1929	1930
Present Before Logging	26	26	25
1925	3	22	14
1926	17	40	23
1927	31	28	28
1928	5	15	31
1929	-	15	32
1930	-	-	32
Totals	82	146	185
Ribes Per Acre	8.2	14.6	18.5

3. Results obtained. There are a few interesting things which the above table brings out. The old bushes seem to be holding their own with the brush species as only one has died within the last few years. During 1930, 32 new bushes appeared on the plot.

Data in the table do not represent a true germination and survival rate because some of the bushes are missed, probably die, and no record is ever made of them. However, this study is an indication of what takes place on an area which has been cut and on which Ribes have not been eradicated. The number of Ribes for 1930 shows an increase over the number for the previous year.

H. Moisture Studies on Dry Exposure.

1. Purpose of study. Generally Ribes are not as numerous on dry slopes as they are on the moist slopes. Neither do they appear to restock an area

quite so readily when dry conditions prevail. This study was started to note the influence of moisture on the germination and survival of Ribes on dry sites.

2. Methods used. A set of 12 fenced plots on a gentle south slope, each 2 milacres in size were established and the soil disturbed in various ways. Half of the plots were irrigated from a near-by spring, while the other half were not. Whole fruits were planted in all the plots and staked to facilitate relocation.

TABLE NO. 6

STUDY OF SEEDLING SURVIVAL UNDER DRY AND MOIST CONDITIONS

Type Plots	Duff Removed - Soil Cultivated		Duff and Soil Cultivated Together		Soil and Duff Undisturbed	
	Number Germinating	Number Surviving	Number Germinating	Number Surviving	Number Germinating	Number Surviving
Irrigated	31	20	68	45	50	3
Non-irrigated	63	13	56	3	25	8

3. Results obtained. The fruits which were planted on the irrigated and non-irrigated plots germinated about equally well. A greater number of seedlings survived on the irrigated plots than on the non-irrigated with the exception of the group where the soil was left undisturbed. The results of this study so far indicate that conditions for germination on the dry slopes are favorable in the spring. What seed is stored in the duff germinates in the spring but as the season advances the soil becomes dry and most of the seedlings die. This condition depletes the amount of seed stored in the soil and probably accounts for the sparse Ribes population on south slopes.

RESULTS OF TEMPORARY STUDIES

A. Duff Analysis for Stored Seed.

During the latter part of the field season of 1930 samples of duff were taken from 26 different sites, which included as many variations as possible. A sample one meter square was laid off for each plot. The outline of the latter was made with a large sharp knife. The soil and duff were divided into three layers, namely; (1) the top or loose layer of needles and other debris; (2) the compacted humus layer; (3) the upper

two inches of mineral soil. Each layer was separately removed, screened, and the screenings placed in paper bags.

These samples were run through a small fan mill. Various kinds of seed were recovered in all three layers, but no attempt has been made as yet to identify them. As a control, known numbers of Ribes seeds were mixed with various samples of duff and soil, and it was possible to recover 100 per cent of the seed.

Fifty-four per cent of the samples taken from the top layer of the duff contained seed. The duff was collected late in the fall, so it is not surprising that seeds should be found in that layer. Sixty-seven per cent of samples taken from the second or the compact layer contained seeds. In the samples of the third layer or the upper two inches of mineral soil, seed was found in only 39 per cent of the samples. From one to fifty seeds were found in the samples with an average of about 10 per sample. Most of the seeds which were found in the layer of mineral soil were small, round and black. In fact, about 75 per cent by number of all the seeds were of this description. It is probably one of the Gilias.

B. Strip Transect Studies, Sierra National Forest.

1. Purpose of study. This study was undertaken on the Sierra National Forest to obtain, by a rapid and large-scale sampling, information on some of the following points: (1) what yearly changes in the Ribes population takes place on cut-over and cut-over and burned areas; (2) at what age do the Ribes begin to fruit heavily; (3) what is the Ribes population by timber type; (4) what is the average increase in live stem per year; (5) how soon after logging does Ribes establishment begin; (6) how long does it continue; and (7) any information concerning Ribes which seems pertinent to suppression methods.

2. Methods used. Strips were run with box compass and 2-chain topographic tape at 20-chain intervals through the cut-over areas. The strips or transects were 13.2 feet wide and often 3 to 5 miles in length, but for convenience the transects were divided into stations one chain long and 13.2 feet wide. All Ribes were checked by stations and recorded on standard forms. Maps of the logging areas showing the year each section was cut and information from logging scars assisted in determining the ages of various logged areas.

3. Description of Area. Most of the area which was logged prior to 1923 belonged to private operators. Hence, practically all of the timber was removed. The Forest Service owned a few narrow strips of timber around the edges which were only partially cut. These areas were included with the clear-cut areas in compiling the data. Practically all of the 1924 cuttings and a small part of the 1923 cuttings were made on Forest Service land.

Logging was begun on the area in 1923, but only a small amount of timber was cut. Starting in 1924 a large area was logged and then burned over. In 1925 another fire started during the logging season and burned over most of the 1923 and 1924 cut-overs and a small portion of the 1925 cut-over. Both of these fires were rather severe due to the logging debris which was scattered over the ground and to the dryness of the season. Although the boundaries of the two burns do not coincide, the 1925 overlapped the one of 1924. For this reason all of the 1923, 1924 and 1925 cut-over lands which were burned in 1924 and 1925 were classified as "1925 burn". It would have been impossible to have separated the burns due to the severity of both of them.

A great deal of the burned area was covered with a dense thicket of spring brush (Ceanothus cordulatus) which made working conditions difficult. Wherever a heavy burn occurs it is usually possible to find small patches of ground that have been burned lightly or not at all. These conditions are usually found in moist places where duff and debris are thin, where a fire has suddenly swept up a slope singeing the brush, and where for some reason or another the fire jumps and leaves a path unburned. All of the previous mentioned conditions were found on this 2,000-acre heavy burn.

The balance of the unburned area logged from 1923-1930 constitutes approximately 13,000 acres of contiguous cut-over land.

4. Results obtained from strip transect studies. The following tabulations summarize Ribes conditions on the Minarets cutting area of the Sierra National Forest. Data were taken in July, 1930.

The area was divided into sugar pine-fir and sugar pine-yellow pine eradication types. No separate records were kept for stream type. Most of the strips crossed the streams at right angles; hence, data taken in stream type were not sufficient to materially influence the data of the other types.

TABLE NO. 7

BUSH DATA ON VARIOUS AGED CUTTING AREAS, ALL TYPES

Year of Logging	Bushes Per Acre All Species and Ages	Feet Live Stem Per Acre
1930	60	3,067
1929	80	601
1928	167	1,501
1927	253	3,131
1926	171	4,150
1925	230	8,257
1925 burn	212	7,810

TABLE NO. 8

DISTRIBUTION OF RIBES ROEZLI BY TYPES FOR VARIOUS AGED CUTTINGS

Year of Logging	[illegible] Type		[illegible] Type	
	Number Bushes Per Acre	Feet Live Stem Per Acre	Number Bushes Per Acre	Feet Live Stem Per Acre
1930	16	212	37	2,743
1929	56	295	26	315
1928	54	377	56	410
1927	52	1,014	55	1,150
1926	80	1,275	68	1,494
1925	120	2,363	85	3,360
1925 burn	132	3,341	75	2,856

The above data includes all R. roezli bushes found on the areas.

TABLE NO. 9

RIBES APPEARING ON VARIOUS AGED CUTTING AREAS SINCE CUTTING

	SP-Fir Type				SP-YP Type			
	R. roezli		R. nevadense		R. roezli		R. nevadense	
Year of Logging	Number Bushes Per Acre	Feet Live Stem Per Acre	Number Bushes Per Acre	Feet Live Stem Per Acre	Number Bushes Per Acre	Feet Live Stem Per Acre	Number Bushes Per Acre	Feet Live Stem Per Acre
1930	2	0.1	0	0	16	0.5	0	0.0
1929	28	2.6	10	7	16	1.6	0	0.0
1928	24	46.0	66	22	50	230.0	3	1.7
1927	78	424.0	50	175	75	438.0	26	130.0
1926	69	802.0	21	454	67	766.0	5	120.0
1925	105	1,420.0	39	650	68	1,410.0	10	278.0
Burned 1925	75	1,602.0	19	410	62	1,323.0	7	387.0

TABLE NO. 10

RIBES ESTABLISHMENT FOLLOWING LOGGING AND BURNING 1925 CUTTING AREA

	SP-F Type				SP-YP Type			
	Bushes Per Acre		Feet Live Stem Per Acre		Bushes Per Acre		Feet Live Stem Per Acre	
Year of Germination	Cut Only	Cut and Burned	Cut Only	Cut and Burned	Cut Only	Cut and Burned	Cut Only	Cut and Burned
1930	23	26	3.5	2.6	26	16	2.8	1.8
1929	19	3	28.0	9.0	14	7	21.0	6.0
1928	24	8	155.0	78.0	15	6	122.0	38.0
1927	20	11	412.0	174.0	13	9	246.0	173.0
1926	11	18	478.0	712.0	10	12	431.0	453.0
1925	6	13	298.0	627.0	7	11	567.0	687.0
Old bushes	15	23	1,542.0	1,439.0	17	12	1,960.0	1,332.0
Totals	120	102	2,946.5	3,041.6	102	75	3,355.8	2,588.8

TABLE NO. 11

RATE OF GROWTH OF RIBES ON CUT-OVER AND BURNED AREAS, 1925 CUTTING AND BURN

Age of Bush	SP-Fir Type: Feet Live Stem Per Average Bush				SP-YP Type: Feet Live Stem Per Average Bush			
	Cut Only		Cut and Burned		Cut Only		Cut and Burned	
	R.roez.	R.nev.	R.roez.	R.nev.	R.roez.	R.nev.	R.roez.	R.nev.
1 year	.1	.1	.1	.1	.1	.1	.1	.1
2 years	1.5	2.0	3.0	8.0	1.5	1.0	1.0	3.0
3 years	8.0	8.0	10.0	12.0	8.0	8.0	5.0	12.0
4 years	21.0	24.0	16.0	14.0	19.0	20.0	15.0	25.0
5 years	43.0	37.0	35.0	29.0	43.0	27.0	25.0	63.0
6 years	50.0	51.0	45.0	36.0	85.0	47.0	59.0	173.0
7+ years	105.0	183.0	65.0	36.0	115.0	103.0	111.0	192.0

DISCUSSION AND CONCLUSIONS

Table No. 7 represents a summary of a census of the Ribes population of various age cuttings taken during July, 1930. The census includes all species of Ribes occurring on both eradication types. This information is presented to show existing Ribes conditions on the cut-over areas of the Sierra Forest. On the 1925 burn Ribes eradication would be exceedingly difficult because of the dense thickets of Ceanothus cordulatus.

Table No. 8 shows the total number of R. roezli bushes and feet of live stem per acre by types on the various aged cut-over areas. The large number of old bushes influences the results so that it is not possible to determine what has actually taken place.

Table No. 9 shows the number of new R. roezli and R. nevadense bushes and their corresponding feet of live stem per acre for the various aged cutting areas. The old bushes, or the ones present before logging, were not included in this table.

Table No. 10 compares Ribes conditions on a 1925 burn and a 1925 cut-over area. More bushes were produced during 1927, 1928 and 1929 on the cut-over area than on the burned area. The dense growth of Ceanothus brush may be responsible in keeping down Ribes on the burned area. In spite of the heavy burn many old bushes escaped the fire.

Table No. 11 shows the average size of Ribes bushes of different ages on a 1925 cutting and burned area. Most of the 1930 bushes were found to have approximately 1/10th of a foot of live stem. Hence that figure was arbitrarily applied to all 1930 seedlings. It is possible to follow the bushes from 1930 to 1925 and see approximately how much the bushes increase in size from year to year. Both species of Ribes apparently

grow at approximately the same rate. Growth rate is similar on cut-over areas and cut and burned areas, and in the two eradication types.

SUMMARY

A. The transect or temporary studies have provided the following information:

1. Some of the 3-year-old R. <u>roezli</u> bushes produce a few fruits but the 4-year-old bushes bear fairly heavy crops of fruits.

2. Ribes establishment begins immediately after logging but does not attain optimum development until the third, fourth and fifth years.

3. Ribes population increases on an area every year for six years or more.

4. On a heavy burn Ribes establishment apparently proceeds in a fairly natural manner for two or three years, after which time the increase is reduced. The reduction is probably due to the heavy concentration of Ceanothus brush that comes into an area after a fire. This conclusion is based on the comparison of a 1925 cut-over and a 1925 burn.

5. The average Ribes bush increases from approximately 1/10th of a foot to 83 feet of live stem over a period of six years.

6. Heavy brush thickets in which numerous Ribes occur are found on heavily burned areas.

7. Observations have shown that rodents transport large quantities of R. <u>roezli</u> seeds.

8. Birds consume R. <u>nevadense</u> fruits without damaging the viability of the seeds.

9. It is recommended that Ribes eradication be performed on logged areas the fourth year following logging. If eradication is postponed too long the bushes become larger and more difficult to remove. Heavy fruiting adds more seed to the soil, and the Ribes intermingle with the brush, making grubbing difficult.

CALIFORNIA RE-ERADICATION STUDIES AND MISCELLANEOUS EXPERIMENTS

By

W. V. Benedict, Assistant Forester,
T. H. Harris, Junior Forester

RE-ERADICATION

A. Introduction

It is not possible on many sites to achieve at a reasonable cost permanent Ribes suppression by one eradication. There are several reasons for this:

1. At the time of eradication there are many Ribes plants too small to be readily located.

2. Disturbances to the ground cover, such as logging and fire, favor Ribes seed germination and frequently result in a formidable crop of seedlings.

3. On moist sites, where Ribes are profuse, many viable fragments of root and crown are broken off during eradication work and later sprout.

Subsequent eradications are therefore necessary on certain sites to insure pine protection.

B. Purpose of Work

To study Ribes conditions and re-eradication costs on an area 3 and 4 years after the initial eradication for information on the following points:

1. The number of Ribes on the area and comparison with the original number.

2. Proportion of new bushes (seedlings) to sprouts and missed bushes, both as to number and amount of live stem.

3. The proportion of fruiting bushes 3 and 4 years after original eradication.

4. Rate of growth of seedlings.

5. The portion of the original eradication area needing reworking.

6. Proper time to perform re-eradication.

7. Checking of re-eradication.

8. Cost of second eradication and comparison with original cost.

C. Location of Area

Re-eradication studies were conducted on the 1926 and 1927 experimental Ribes eradication areas in township 4 north, range 18 east, Stanislaus National Forest. These areas were selected because:

1. They are contiguous areas representing two seasons of eradication work.

2. Different aged timber sales were represented. Some cutting was done just before eradication work and some shortly after. There were also old cutting areas represented.

3. A preliminary examination of these areas showed numerous Ribes seedlings, some of which were fruiting, of sufficient size and quantity to warrant re-eradication studies.

D. Methods of Work

The 1926 and 1927 eradication areas were considered as separate units. Original block boundaries were re-established wherever possible and the block completely reworked. In some cases only a portion of a block was reworked due to lack of time. On three blocks no re-eradication work was done. (See map accompanying this report.)

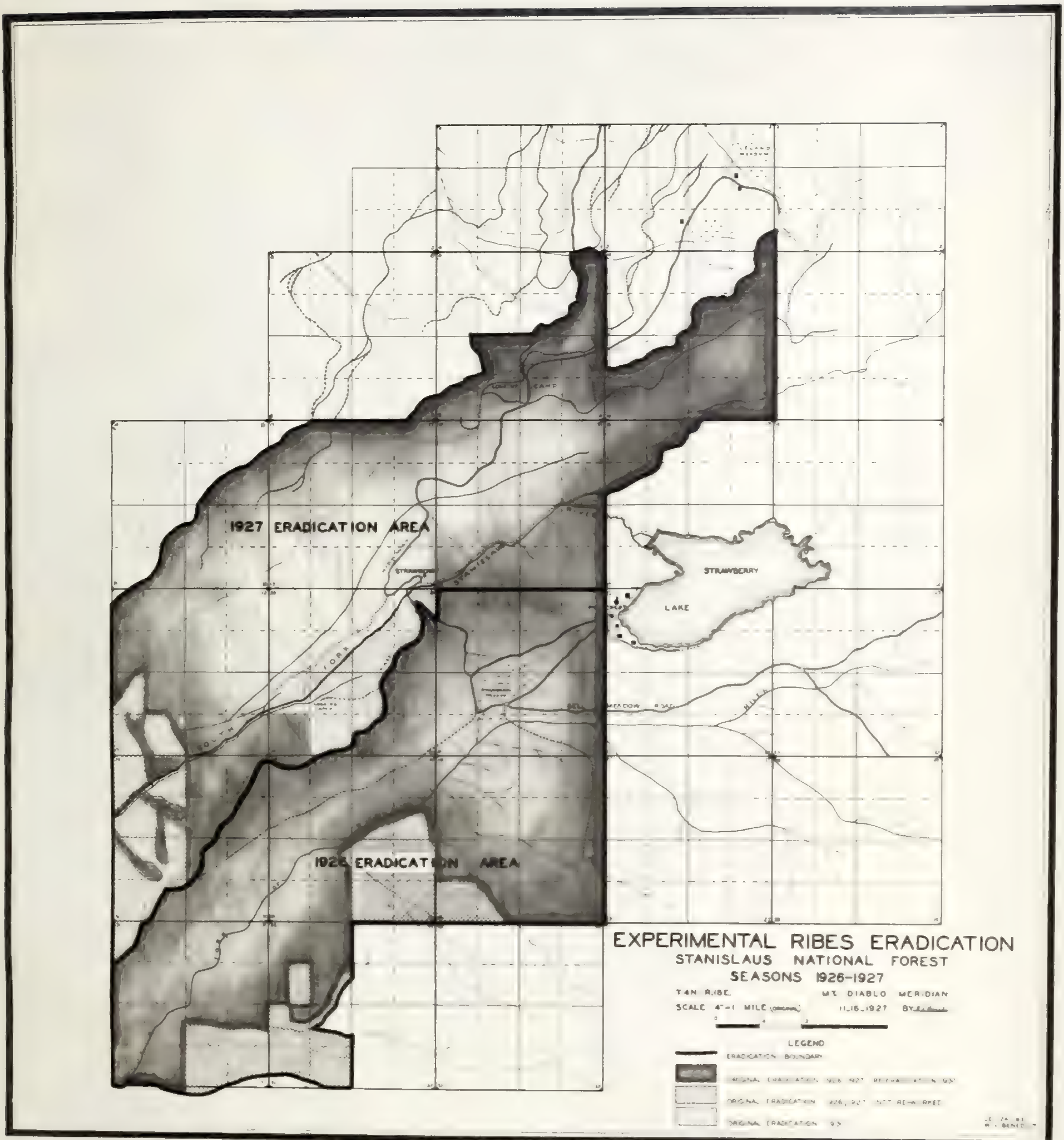
Three-man crews were used exclusively. The 3-man crew had proved most successful on previous eradication operations. A fourth man (recorder) was attached to each crew to analyze and record on special forms all Ribes data. This man did no eradication work and his time was not charged against re-eradication costs. All men were experienced eradication men.

On areas where Ribes were few and scattered the men spread out and functioned as a scout crew. Where Ribes were numerous an intensive formation was employed.

From 2 to 5 per cent of the area of each block was systematically checked for missed bushes by running check strips on a compass course at periodic intervals across blocks. Blocks suspected of containing few Ribes were checked in advance of crew work and when found free of Ribes were eliminated from further consideration.

E. Results of Work

1. The gross results of the season's work show 5,825 acres (37%)



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covered by the re-eradication crews out of the 6,870 acres comprising the two experimental areas. The accompanying map shows by cross-hatching the portions not worked. 180,909 bushes having 1,004,767 feet of live stem were pulled. This is an average of 31 bushes and 173 feet of live stem per acre.

Table 1 is a summary by areas and by types of work done.

<u>TABLE NO. 1</u>

<u>SUMMARY OF RE-ERADICATION, BUSHES PULLED, STANISLAUS NATIONAL FOREST, CALIFORNIA, 1930</u>

Erad. Unit	Eradication Type	Acres	Man-Days		Seedlings		Sprouts		Missed		Totals	
			Crew	Recorder	Bushes	Feet Live Stem	Bushes	Feet Live Stem	Bushes	Feet Live Stem	Bushes	Feet Live Stem
1927	SP-YP CO	2,034	73-7/8	25-5/8	10,706	156,619	893	18,498	641	48,665	12,240	223,782
	SP-F CO	1,016	210-7/8	67-7/8	37,662	239,584	3,270	39,566	2,363	85,378	43,295	364,528
	Stream CO	150	62	20	33,362	56,209	554	5,364	214	6,960	34,130	68,533
	Totals	3,200	346-3/4	113-1/2	81,730	452,412	4,717	63,428	3,218	141,003	89,665	656,343
1926	SP-YP CO	751	81-7/8	26-5/8	5,498	23,756	1,401	28,331	468	25,902	7,367	77,989
	SP-YP Nat.	340	1-3/4	-	177	1,019	74	512	69	2,631	320	4,162
	SP-F CO	1,071	163-3/8	52-7/8	38,541	85,462	4,088	39,575	998	23,896	43,627	149,933
	SP-F Nat.	137	43-1/2	12-3/4	898	1,489	866	5,915	2,410	32,655	4,174	40,059
	Stream CO	326	84-3/8	28-7/8	32,735	34,146	2,435	24,972	586	17,663	35,756	76,781
	Totals	2,625	374-7/8	121-1/8	77,849	145,872	8,864	99,305	4,531	102,747	91,244	347,924
1926 and 1927	Totals	5,825	721-5/8	234-5/8	159,579	598,284	13,581	162,733	7,749	243,750	180,909	1,004,767

Table 2 shows the Ribes per acre occurring on the different types. The bushes are separated into the three classes of seedlings, sprouts, and missed bushes. Seedlings are those which germinated since the first eradication, sprouts are those originating from the crowns and roots of partially eradicated bushes of the first eradication, and missed bushes designate those overlooked.

TABLE NO. 2

RIBES PER ACRE, RE-ERADICATION, STANISLAUS NATIONAL FOREST, CALIFORNIA, 1930

Erad. Unit	Eradication Type	Acres	Man-Days Per Acre		Ribes Per Acre							
					Seedlings		Sprouts		Missed		Totals	
			Crew	Rec.	Bushes	F.L.S.	Bushes	F.L.S.	Bushes	F.L.S.	Bushes	F.L.S.
1927	SP-YP CO	2,034	.036	.013	5.3	77	.4	9	.3	24	6.0	110
	SP-F CO	1,016	.208	.067	37.1	236	3.2	39	2.3	84	42.6	359
	Stream CO	150	.413	.138	222.4	375	3.7	36	1.4	46	227.5	457
	Averages	3,200	.108	.035	25.5	141	1.5	20	1.0	44	28.0	205
1926	SP-YP CO	751	.109	.035	7.3	32	1.9	38	.6	34	9.8	104
	SP-YP Mature	340	.005	-	.5	3	.2	1	.2	8	.9	12
	SP-F CO	1,071	.153	.049	36.0	80	3.8	37	.9	22	40.7	139
	SP-F Mature	137	.218	.093	6.6	11	6.3	43	17.6	238	30.5	292
	Stream	326	.259	.089	100.4	105	7.5	77	1.8	54	109.7	236
	Averages	2,625	.143	.046	29.7	56	3.4	38	1.7	39	34.8	133
1926 and 1927	Totals or Grand Averages	5,825	.124	.040	27.4	103	2.3	28	1.3	42	31.0	173

On the 1927 area there was originally an average of 60 Ribes per acre as against 28 found by re-eradication. On the 1926 area there was originally an average of 59 Ribes per acre whereas re-eradication showed 35. The apparent explanation is the difference in the time of eradication on the two areas. Four years had elapsed before re-eradication on the 1926 unit, and only three years for the 1927. The additional year allowed seven more bushes per acre to become established. Other factors have probably influenced this result, since these areas have been considerably altered by logging operations prior to and since the first eradicative work, and not to the same degree upon each. It is difficult to measure the effect of these disturbances with a view to accurately comparing eradication types because of time variations in their incidence. The types themselves have changed; most of the mature types have been cut over.

A comparison by blocks of Ribes per acre of the original eradication with re-eradication is given by the frequency curve charts 2 and 3. The most significant fact brought out by these charts is the reduction in Ribes per acre from an average of 59.5 for both areas, found by the original eradication, to 31 per acre. The 1930 (re-eradication) curve for the 1927 area falls below the 1927 curve in all but four cases, where the actual number of Ribes found the second time was greater than that found the first. Similar curves for the 1926 area show the variations found there. Disturbances due to logging following the initial eradication probably account for these increases in bushes per acre for certain blocks as shown by the crossing of the curves. Changes brought about by logging, such as exposure of mineral soil, increased sunlight to ground cover, and alterations in available soil moisture favor Ribes germination and growth. In every case where an increase occurred, logging took place at the time of or subsequent to eradication.

In 1927 _R. roezli_ composed 78 per cent of the total bushes and in 1930 the percentage had fallen to 63. The remaining percentage is _R. nevadense_ and a few individual bushes of _R. cereum_ and _R. hallii_, which were all placed together for convenience. In 1926 _R. roezli_ constituted 80 per cent of the bushes and in 1930 it formed 70 per cent. Chart 1, figure 1, shows the average for both years. Table 2 shows the percentages of Ribes species by types. The probable explanation of the decrease in percentage of _R. roezli_ is because of the exceedingly prolific seedling production made by _R. nevadense_ in stream type.

On the 1927 area there was originally an average of [illegible] ribes per acre as against 38 found by re-eradication. On the 1926 area there was originally an average of 99 ribes per acre whereas re-eradication showed 45. The apparent explanation is the difference in the time of eradication on the two areas. Four years had elapsed before re-eradication on the 1926 unit, and only three years for the 1927. The additional year allowed seven more bushes per acre to become established. Other factors have probably influenced this result, since these areas have been considerably altered by logging operations prior to and since the first eradication work, and not to the same degree upon each. It is difficult to measure the effect of these disturbances with a view to accurately comparing eradication types because of the variations in their incidence. The types themselves have changed; most of the mature types have been cut over.

A comparison by blocks of ribes per acre of the original eradication with re-eradication is given by the frequency curve charts 2 and 3. The most significant fact brought out by these charts is the reduction in ribes per acre from an average of [illegible] for both areas, found by the original eradication, to 21 per acre. The 1930 (re-eradication) curve for the 1927 area falls below the 1927 curve in all but four cases, where the actual number of ribes found the second time was greater than that found the first. Similar curves for the 1926 area show the variations found there. Disturbances due to logging following the initial eradication probably account for these increases in ribes per acre for certain blocks as shown by the crossing of the curves. Changes brought about by logging, such as exposure of mineral soil, increased sunlight to ground cover, and alterations in available soil moisture favor ribes germination and growth. In every case where an increase occurred, logging took place at the time of or subsequent to eradication.

In 1927 *R. roezli* comprised [illegible] per cent of the total bushes and in 1930 the percentage had fallen to [illegible]. The remaining percentage is *R. nevadense* and a few individual bushes of *R. cereum* and *R. hallii*, which were all placed together for convenience. In 1926 *R. roezli* constituted [illegible] per cent of the bushes and in 1930 it formed [illegible] per cent. Chart 1, Figure 1, shows the average for both years. Table 2 shows the percentages of ribes species by types. The probable explanation of the decrease in percentage of *R. roezli* is because of the exceedingly prolific seedling production made by *R. nevadense* in stream type.

CHART 1

RIBES SPECIES IN PERCENTAGE OF TOTAL

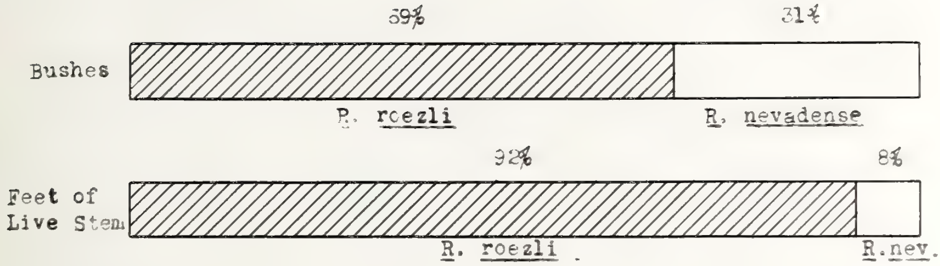

Figure 1

SIZE OF AVERAGE BUSH

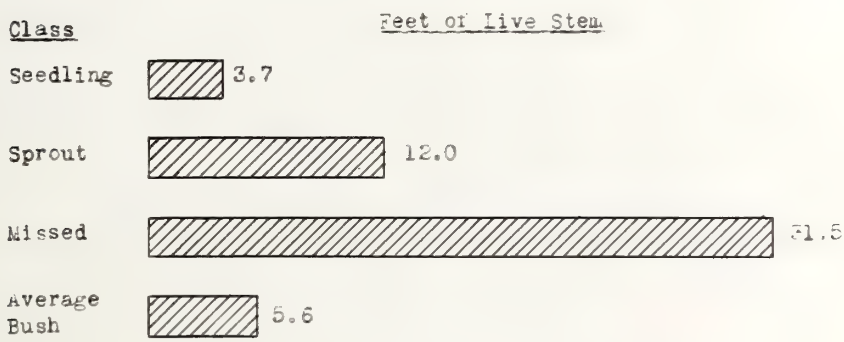

Figure 2

RELATION OF BUSHES TO FEET OF LIVE STEM BY CLASSES IN PERCENTAGE OF TOTAL

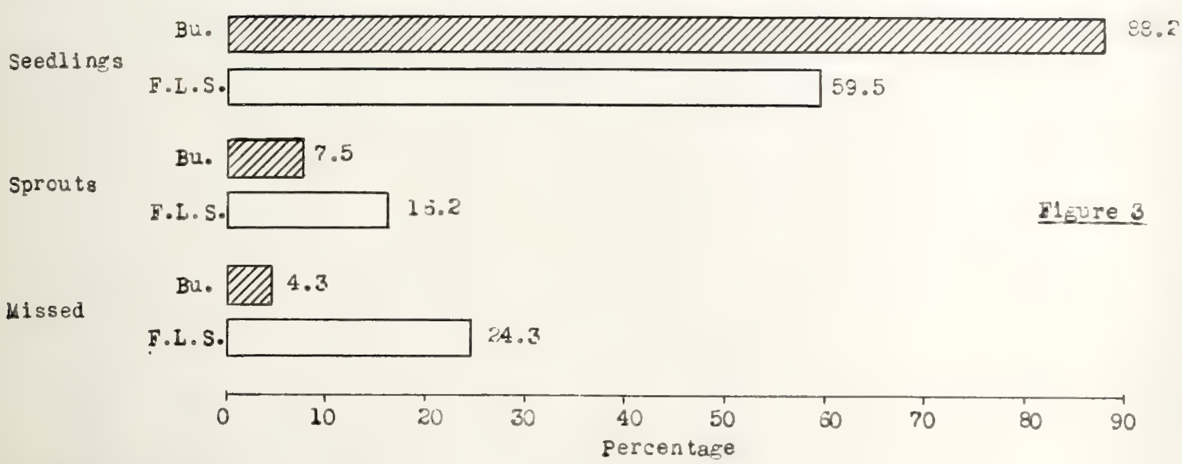

Figure 3

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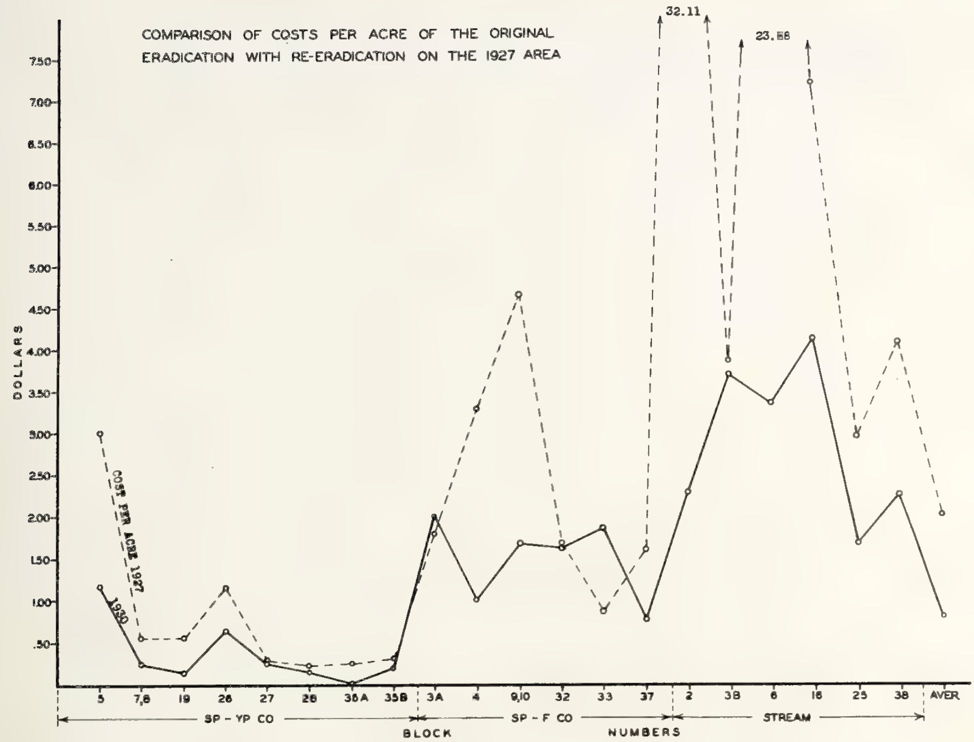

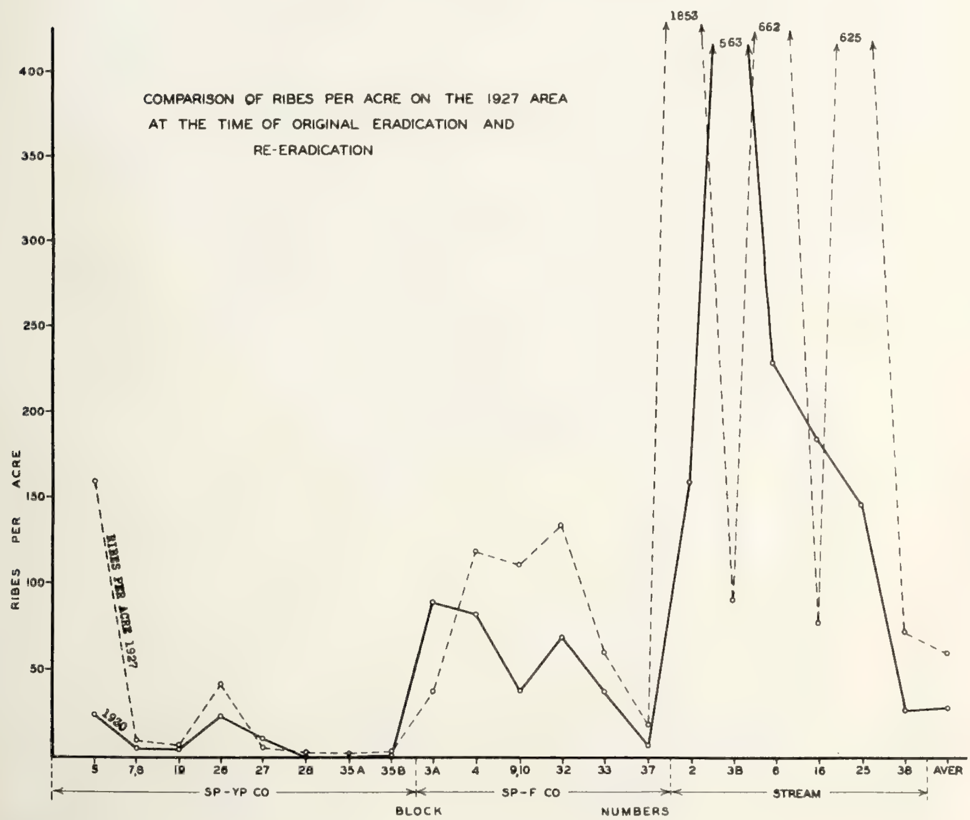

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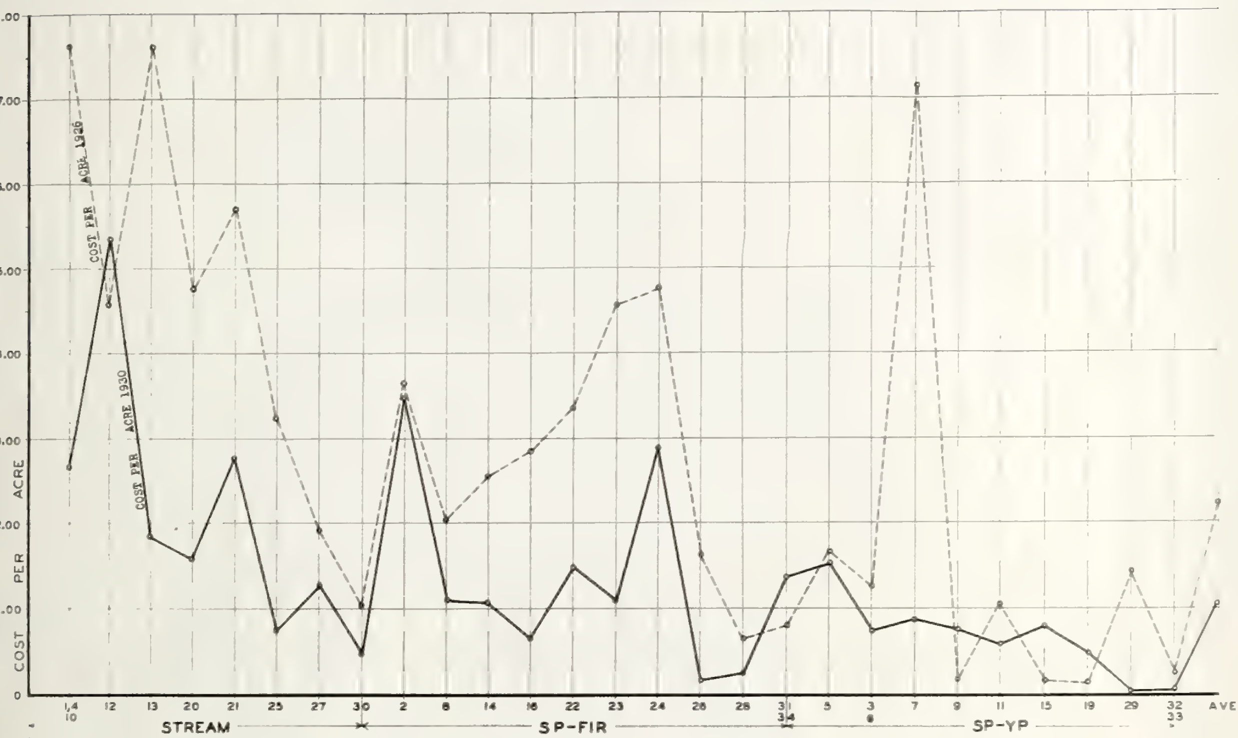
CHART 3

COMPARISON OF COSTS PER ACRE OF ORIGINAL ERADICATION WITH RE-ERADICATION—1926 AREA



COMPARISON OF RIBES PER ACRE OF ORIGINAL ERADICATION WITH RE-ERADICATION—1926 AREA

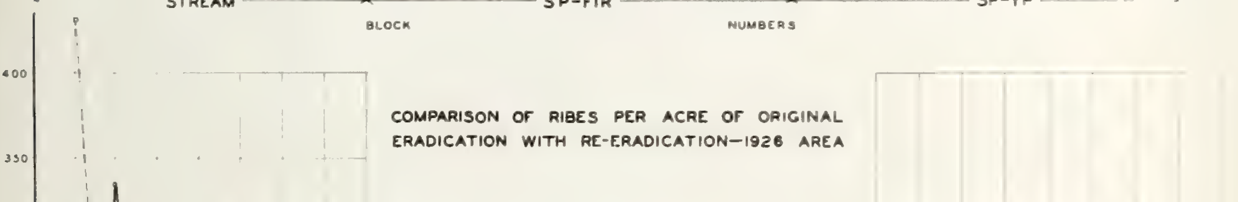


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TABLE NO. 3

PERCENTAGES OF RIBES BY SPECIES

Erad. Unit	Eradication Type	Percentages by Species			
		R. roezli		R. nevadense	
		% Bushes	% F.L.S.	% Bushes	% F.L.S.
1927	SP-YP CO	85	98	15	2
	SP-F CO	88	97	12	3
	Stream CO	24	41	76	59
	Average	63	91	37	9
1926	SP-YP CO	95	99	5	1
	SP-YP Mature	98	99.8	2	0.2
	SP-F CO	83	94	17	6
	SP-F Mature	92	95	8	5
	Stream CO	58	79	42	21
	Average	75	92	25	8
1927 and 1926	Averages	69	92	31	8

2. Table 4 shows that 88 per cent of all bushes are seedlings, that is, had their origin since the first eradication, 8 per cent are sprouts, and 4 per cent are missed bushes. The seedlings, however, have 60 per cent of the live stem, sprouts have 16 per cent, and missed bushes 24 per cent. This is shown graphically by chart 1, figure 3. Frequently in the field it was difficult for the crewmen to accurately classify the bushes. The characters distinguishing a sprout were many times obscure and even lacking, and small suppressed missed bushes could very easily be mistaken for seedlings. Because of this it is thought that the seedling class has more than its full share of bushes at the expense, particularly of the missed group.

TABLE NO. 4

PERCENTAGES OF RIBES CLASSES BY TYPES

Erad. Unit	Eradication Type	Percentages of Ribes by Species					
		Seedlings		Sprouts		Missed	
		% Bushes	% F.L.S.	% Bushes	% F.L.S.	% Bushes	% F.L.S.
1927	SP-YP CO	88	70	7	8	5	22
	SP-F CO	87	66	8	11	5	23
	Stream CO	97.8	82	1.6	8	0.6	10
	Average	91	69	5	10	4	21
1926	SP-YP CO	75	31	19	36	6	33
	SP-YP Mature	55	25	23	12	22	63
	SP-F CO	88	57	10	27	2	16
	SP-F Mature	21	4	21	15	58	81
	Stream CO	92	44	7	33	1	23
	Average	85	42	10	28	5	30
1927 and 1926	Averages	88	60	8	16	4	24

The question of the size of the average bush is naturally raised by these considerations. The average seedling has 3.7 feet of live stem, the average sprout 12.0 feet, and the average missed bush 31.5 feet. (See chart 1, figure 2.)

3. In order to ascertain the percentages of seedlings, sprouts and missed bushes bearing fruit, data on this point were taken when the bushes were pulled. Table 5 shows by type the percentage of Ribes of each class producing fruit. Three per cent of the seedlings on the 1927 area and 0.4 per cent of those on the 1926 area were fruiting. This disparity in the two areas is also shown in the sprouts and missed bush classes and is difficult to explain. Differences between the areas in density of ground cover, time and intensity of logging, and perhaps slope may offer suggestions as to causes.

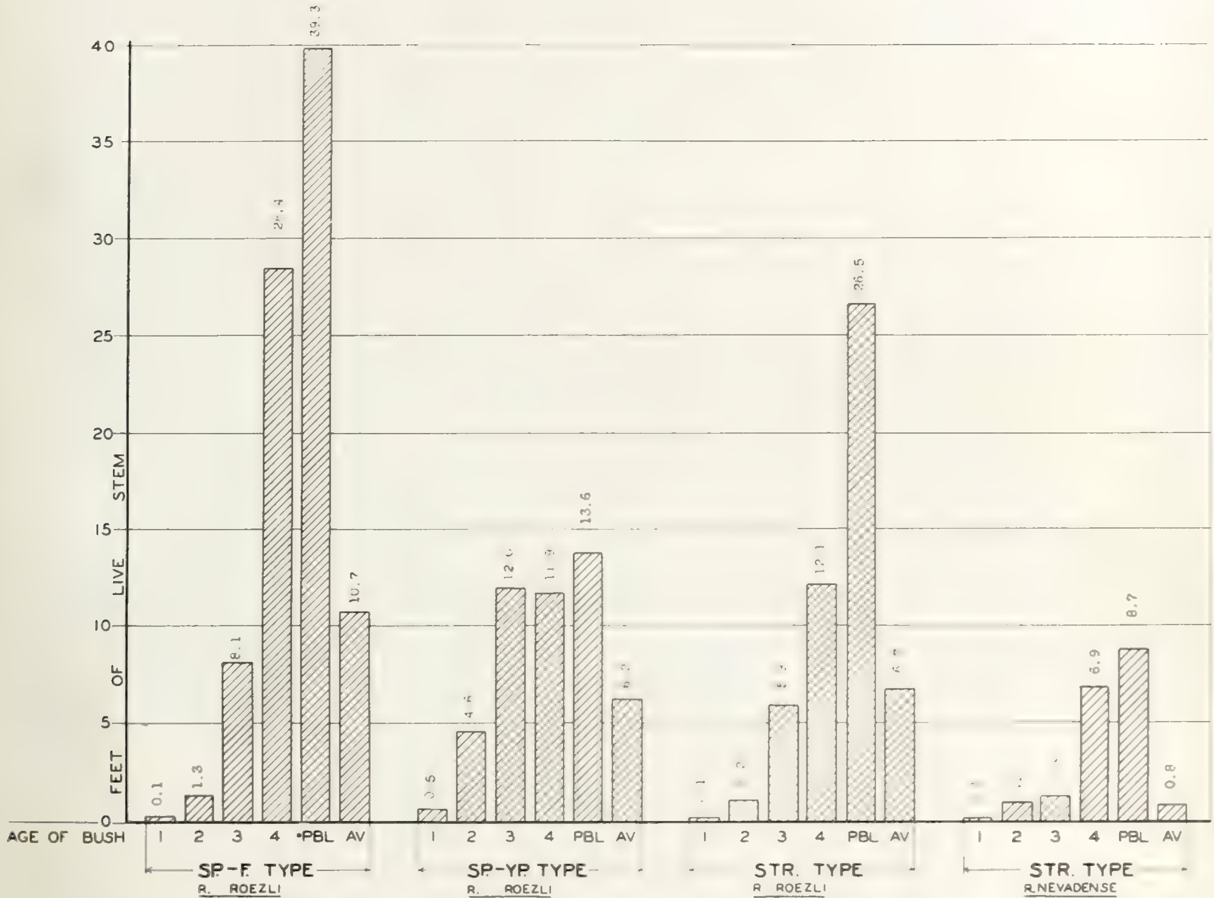
TABLE NO. [illegible]

PERCENTAGES OF RIBES FRUITING

Erad. Unit	Eradication Type	Percentages of Bushes Fruiting		
		% Seedlings	% Sprouts	% Missed
1927	SP-YP CO	8.0	28.4	50.4
	SP-F CO	4.1	20.0	29.7
	Stream CO	0.3	14.6	31.3
	Average	3.0	21.0	33.9
1926	SP-YP CO	1.3	24.3	41.5
	SP-YP Mature	0.0	6.8	40.6
	SP-F CO	0.6	13.0	22.4
	SP-F Mature	0.0	4.6	7.8
	Stream CO	0.09	13.8	28.2
	Average	0.4	14.1	17.7
Average for 1927 and 1926		1.8	16.5	24.4

4. Information was desired as to the rate of growth of R. roezli and R. nevadense during the early years of their existence. Accordingly the amount of live stem was measured and the age determined for each bush on sample areas of the three cut-over eradication types. Bushes ranged from those of the current season to an age of four years, beyond which exact ages could not be accurately determined. Bushes older than four years were designated as "present before logging" since four years antedated all logging operations on areas studied. These figures are averaged and presented in diagram form in chart 4. The numbers of bushes upon which the study is based are given in table 6. Insufficient data make a weak point at the fourth season in sugar pine-yellow pine type and to some extent in the third season; likewise R. nevadense in stream type is weak at the fourth season and at "present before logging". The height of the fourth season bar for sugar pine-yellow pine type probably falls in the vicinity of [illegible]0 feet of live stem, which is a more regular gradation.

CHART 4



RATE OF GROWTH OF RIBES ON CUT-OVER AREAS

* Present before [illegible]

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TABLE NO. 6

DATA USED AS BASIS FOR CHART 4

Type	Year Logged	Acres	Number of Bushes					
			1*	2	3	4	P.B.L.**	Total Bushes
SP-YP CO (R. roezli)	1927	54	741	714	66	32	631	2,184
SP-F CO (R. roezli)	1927	22	122	415	366	83	164	1,150
Stream CO (R. roezli)	1927	4	420	457	386	134	250	1,647
Stream CO (R. nevadense)	1927	4	1,471	1,936	718	68	45	4,238

*Age of bushes in seasons of growth. 1 is the current or 1930 season, 2 represents bushes originating in 1929, etc.

**Present before logging.

Although R. roezli is a drought resistant species occurring on the hot southerly exposures of the sugar pine-yellow pine types, it attains its greatest size and greatest rate of growth on the cooler sugar pine-fir slopes. It is not primarily a stream type species and hence it should not be expected to attain optimum growth there, where moisture evidently does not compensate for reduced sunlight and the more competitive conditions of a denser ground cover.

Data depicting rate of growth of R. nevadense, especially for the older bushes, are probably insufficient to fully evaluate the rate of growth the species is capable of making in stream type.

5. All of the original eradication blocks were not reworked by the usual crew method. It was found that parts of the sugar pine-yellow pine cut-over and mature types contained few or practically no Ribes, hence it was not necessary to send crews into them. Into blocks on which a paucity of bushes was suspected a checker was sent to determine their number and occurrence. He was followed by one or two men who cleaned out the patches, if only a few were reported. Thus considerable crew time was saved. Much of the sugar pine-yellow pine type was covered by a regular crew in scout formation, that is, with wide intervals between men.

6. This first re-eradication does not provide complete information as to the proper time to perform re-eradication. Re-eradications must be correlated with the age at which seedlings fruit and the time after

eradication when germination of seed that may be stored in the duff ceases. On this latter point complete information is lacking which subsequent studies will supply. Fruiting 3-year-old bushes, as well as numerous 1930 seedlings found on parts of the eradication area are evidence that these factors were operating. Seed was being produced by the new plants before all stored seed had germinated. The abundance of 1930 seedlings could not well be accounted for by the small number of fruiting sprouts or missed bushes found on the eradication areas, nor could the fruiting seedling group be responsible since but a small number were fruiting and they for the first time. A third eradication will therefore be needed on certain sites on these areas before permanent Ribes suppression will be secured.

7. The efficiency of re-eradication, as found by systematically checking from 2 to 5 per cent of the area of each type, is shown in table 7.

TABLE NO. 7

CHECKING DATA

BUSHES AND LIVE STEM LEFT PER ACRE

Eradication Type	1927 Area Ribes Per Acre	1927 Area F.L.S. Per Acre	1926 Area Ribes Per Acre	1926 Area F.L.S. Per Acre
SF-WP CO	2.6	21	1.8	14.0
SF-WP Mat.	-	-	.03	.07
SF-P CO	7.0	19	7.0	23.0
SF-P Mat.	-	-	10.0	35.0
Stream	50.0	44	23.0	36.0
Average	6.0	21	7.0	20.0

8. Cost of re-eradication. The cost of re-eradication by type is shown in table 8. Charts 2 and 3 delineate the costs per acre and compare them by blocks with the costs of the initial eradication. Generally the 1930 curve falls below the 1926 and 1927 curves, and where they do not, it will be seen by following down the same ordinate to the curves for Ribes per acre just below, that in most cases the bushes per acre have increased the second time. This offers a partial explanation of a rise in costs. Another cause is irregularities in methods of crew work on a few blocks at the beginning of the season.

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7. The efficiency of re-eradication, as found by systematically checking from 2 to 5 per cent of the area of each type, is shown in table 7.

TABLE NO. 7

CHECKING DATA

BUSHES AND LIVE STEM LEFT PER ACRE

Eradication Type	1927 Area Ribes per acre	1927 Area L.S. per acre	1926 Area Ribes per acre	1926 Area L.S. per acre
Sp-D Gr	2.5	14	1.6	16.0
S-D Sat.	-	-	.05	.07
G-S Co	7.0	13	7.0	33.0
S-S Sat.	-	-	10.6	55.0
Stream	20.0	44	22.0	24.0
Average	5.0	18	7.6	30.6

8. Cost of re-eradication. The cost of re-eradication by type is shown in table 8. Charts 2 and 3 delineate the costs per acre and compare them by blocks with the costs of the initial eradication. Generally the 1930 curve falls below the 1926 and 1927 curves, but where they do not, it will be seen by following down the same ordinate to the curves for Ribes per acre just below, that in most cases the bushes per acre have increased the second time. This offers a partial explanation of a rise in costs. Another cause is irregularities in methods of crew work on a few blocks at the beginning of the season.

TABLE NO. 8

RE-ERADICATION COSTS

Eradication Type	Acres	Man-Days	Ribes Eradicated	Number Per Acre	Costs Per Type	Costs Per Acre	Per Cent of Total Cost	Per Cent of Total Area	Per Cent of Total Ribes
1927 Area									
SP-YP CO	2,034	73-7/8	12,240	6.0	$537.10	$0.26	21.3	63.6	13.6
SP-Fir CO	1,016	210-7/8	43,295	42.6	1,533.15	1.51	60.8	31.7	48.3
Stream CO	150	62	34,130	227.5	450.77	3.01	17.9	4.7	38.1
Totals	3,200	346-3/4	89,665	28.0	$2,521.02	$0.79	100.0	100.0	100.0
1928 Area									
SP-YP CO	751	81-7/8	7,367	9.8	$595.27	$0.79	21.8	28.6	8.1
SP-YP Mature	340	1-3/4	320	0.9	12.72	0.04	0.5	13.0	0.3
SP-Fir CO	1,071	163-3/8	43,627	40.7	1,187.81	1.11	43.6	40.8	47.8
*SP-Fir Mat.	137	43-1/2	4,174	30.5	316.27	2.31	11.6	5.2	4.6
Stream CO	326	84-3/8	35,756	109.7	613.44	1.88	22.5	12.4	39.2
Totals	2,625	374-7/8	91,244	34.8	$2,725.51	$1.04	100.0	100.0	100.0
Both Areas									
SP-YP CO	2,785	155-3/4	19,607	7.0	$1,132.37	$0.41	21.6	47.8	10.8
SP-YP Mature	340	1-3/4	320	0.9	12.72	0.04	0.2	5.8	0.2
SP-Fir CO	2,087	374-1/4	86,922	41.6	2,720.96	1.30	51.9	35.8	48.0
*SP-Fir Mat.	137	43-1/2	4,174	30.5	316.27	2.31	6.0	2.4	2.3
Stream CO	476	146-3/8	69,886	146.8	1,064.21	2.24	20.3	8.2	38.7
Totals	5,825	721-5/8	180,909	31.0	$5,246.53	$0.90	100.0	100.0	100.0

*A brushy timber area not typical of the type.

The significant thing brought out is that the average per acre cost of re-eradication is less than half that of original eradication.

F. Statement and Analysis of Costs

Actual field expenditures from which costs per acre were computed are analyzed and allocated to re-eradication and special studies in table 9.

TABLE NO. 9

FIELD EXPENDITURES (MAY 11 TO SEPTEMBER 15, 193[illegible]) FROM WHICH COSTS PER ACRE WERE COMPUTED

Expenditure Classification	Re-eradication	Special Studies	Both	% of Total
Supervision				
Salaries............... $752.78				
Expenses............... 179.14				
	$931.92	-	$931.92	12.4
Labor				
Temporary Assistants	2,316.60	$1,325.86	3,642.46	48.5
Subsistence				
Cost of Food..........$1,810.39				
Cooks' wages.......... 603.33				
Transportation........ 74.27				
Total.................$2,487.99				
*Minus charge to Chemical and Ecology Projects 423.39				
	1,313.09	751.51	2,064.60	27.5
Transportation of men	64.85	37.12	101.97	1.4
Transportation of chemicals	-	25.01	25.01	0.3
Miscellaneous Transportation	53.49	-	53.49	0.7
Supplies				
Twine.................$67.94				
Other................. 46.24				
	114.18	-	114.18	1.5
Chemicals	-	66.64	66.64	0.9
Equipment				
Transportation...........130.07				
Depreciation charge......262.33	392.40			
Special experimental	-	56.92	449.32	6.0
Miscellaneous Expenses	60.00	-	60.00	0.8
Total	$5,246.53	$2,263.06	$7,509.59	100.0

Re-eradication expenses - Expenses incurred by re-eradication only.
Special studies expenses - Expenses resulting from experimental work not connected with re-eradication.

*Subsistence charges incurred by projects 2.45 and 2.3-1.

Table 10 gives the total expenditures for project 2.25 from January 1 to September 30, 1930.

TABLE NO. 10

PROJECT EXPENDITURES - JANUARY 1 TO SEPTEMBER 30, 1930

Expenditure Classification	Amount
Supervision	$1,457.76
Temporary Assistants	4,245.79
Travel Expenses	499.99
Subsistence Supplies	1,810.39
Other Supplies	125.11
New Equipment	101.91
Transportation Supplies and Equipment	121.44
Miscellaneous Expenses	57.57
Total Expenditures	$8,419.96

Subsistence costs are itemized in table 11.

TABLE NO. 11

SUBSISTENCE COSTS

Subsistence Classification	Sub-total	Total
Groceries, bid items	$1,343.91	-
Groceries, non-bid	141.57	-
Fresh meat, on bid	324.91	-
Total food	-	$1,810.39
Cooks' wages	-	603.33
Transportation of food	-	74.27
Total subsistence cost	-	$2,487.99

Number of meals served.......6,417

Cost per meal.......$0.388

G. Future Work

The finding of many bushes of 1930 germination, especially on recently logged areas, and the inference that germination of stored seed will continue for a number of years lead to the conclusion that another re-eradication should be undertaken within three or four years at least on portions of the areas under consideration. Subsequent re-eradications and ecological studies should be undertaken to provide more complete and

comprehensive information on establishment and growth of Ribes on eradication areas.

In 1932 and 1933 Ribes will have established themselves sufficiently on the experimental eradication area at Dorrington on the Stanislaus Forest and at Meadow Valley on the Plumas Forest to warrant a re-eradication.

H. Summary

The greater part of two seasons' eradicative work embracing the 1926 and 1927 experimental areas on the Stanislaus National Forest was freed of Ribes by the re-eradicative project of 1930. An average of 31 bushes per acre was found compared to 58.5 occurring under natural conditions. The seedling class contained by far the largest percentage of bushes, with, however, a smaller percentage of live stem.

The rate of growth of R. roezli in cut-over types is most rapid in sugar pine-fir type where it attains an average growth of forty feet of live stem in four seasons. The highest percentage of seedlings found fruiting was four, a comparatively small figure.

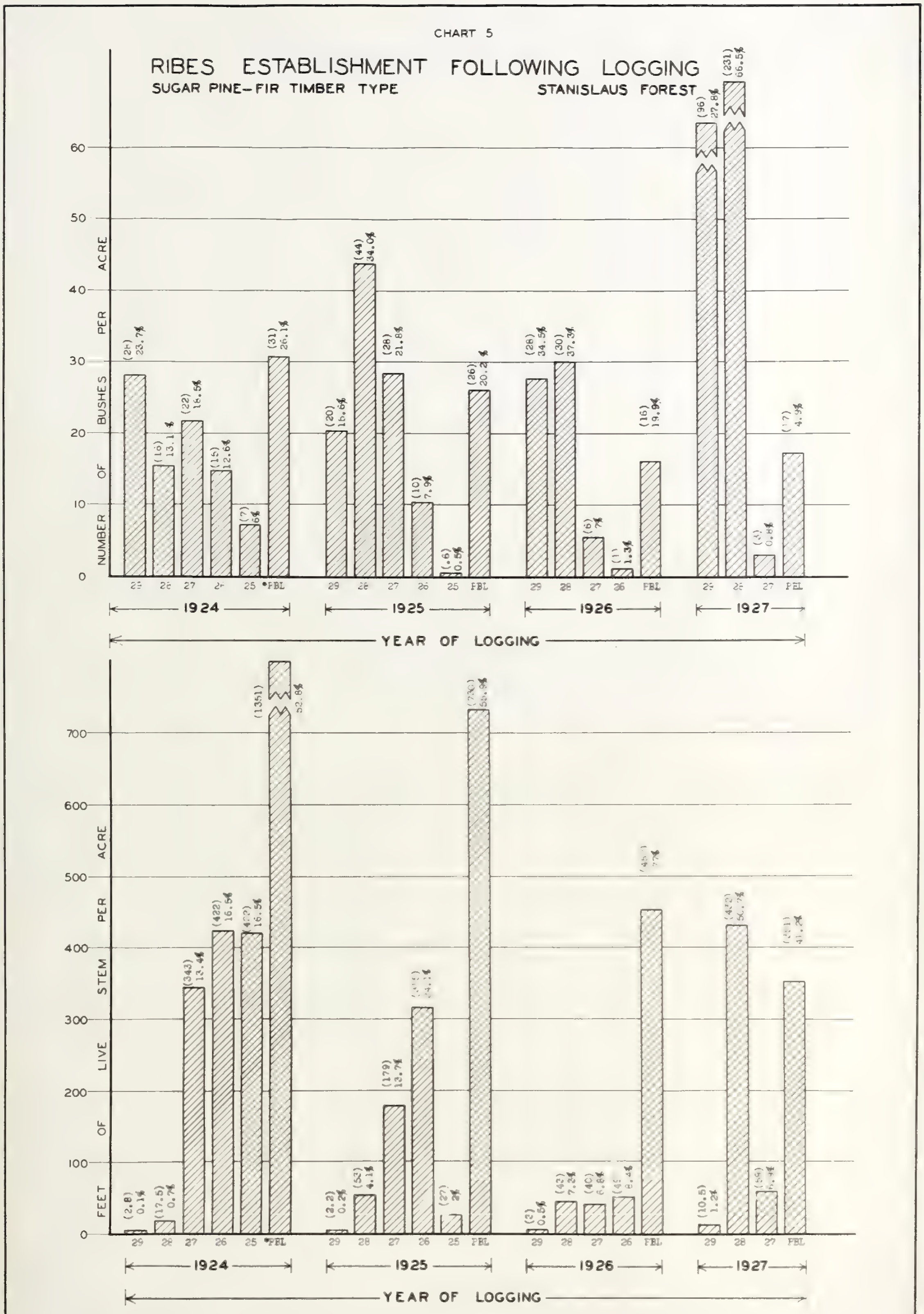
By a system of pre-checking, large blocks were often eliminated from the necessity of coverage by crews, thus materially reducing costs.

MISCELLANEOUS EXPERIMENTS

Under miscellaneous experiments is included other experimental work done on the Stanislaus Forest by the re-eradication project. Some of the studies were conducted in cooperation with the ecology and chemical investigation projects. A discussion of the objectives and results of these studies follows.

1. A study of Ribes establishment following logging. An attempt to shed light on the rate of Ribes establishment following logging by classifying re-eradication data according to year of logging was not productive of satisfying results. The use of more complete and reliable material collected by the California ecology project in 1930 suggested itself, and this material was accordingly worked up with the new end in view, and is presented in chart 5.

Chart 5 illustrates by diagram the number of Ribes and the corresponding amount of live stem occurring per acre segregated according to year of origin following logging on sugar pine-fir timber type. The percentages of the total number of bushes and of the total amount of live stem for each year are given at the top of each bar.



*Present before logging.

Figures in parenthesis represent bushes per acre and feet of live-stem per acre.

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There is apparently a lapse of one to two years after logging before Ribes start appearing on an area in large numbers, at which time, and continuing for three or four years, heavy crops of seedlings are produced. Most of the live stem, however, even on cuttings 4 and 5 years old, is represented by the old plants which were present before logging.

Table 12 shows the number of Ribes used as a basis for chart 5.

TABLE NO. 12

DATA USED AS BASIS FOR CHART 5

Year of Logging	Number of Bushes							
	1929	1928	1927	1926	1925	P.B.L.*	Total	Acres
1924	136	109	153	104	50	216	628	7.0
1925	263	575	363	135	2	341	1,631	13.1
1926	247	267	50	9	-	142	715	8.0
1927	135	328	4	-	-	24	486	1.4
Total	841	1,274	576	248	56	728	3,720	30.4

*Present before logging.

2. A study of the effect of speed on crew work. The primary purpose of this study was to see if eradication costs could be reduced without seriously affecting the efficiency of the work by reducing the time spent in searching for Ribes.

Three areas of equal size and representing similar working conditions were established in sugar pine-fir type. The same 3-man crew was used to eradicate the Ribes from each plot. On the first plot little time was spent in looking for bushes, the object being to proceed at normal walking speed across the area, keeping a sharp lookout for a bes but not making a special effort to search for them. On the second plot the average speed of eradication was maintained, and on the third plot a particularly careful and painstaking gait was followed, the object being to get all the bushes, irrespective of time consumed. All plots were completely checked. Each plot was 3¼ acres in size. Table 13 shows the results of the study.

TABLE NO. 13

EFFECT OF SPEED ON CREW WORK

Crew Speed	Ribes Eradicated	F.L.S. Eradicated	Ribes Missed	F.L.S. Missed	Working Time
Fast	369	5,840	82	270	1 hr. 35 min.
Average	535	6,645	79	150	2 hrs. 55 min.
Slow	421	5,166	35	56	5 hrs. 10 min.

This experiment is not of sufficient size to permit definite conclusions. The results point towards a possibility of cost reductions by speeded-up searching time in crew work. However, speeded searching time results in lowered efficiency and this must be taken into consideration in reducing searching time. A repetition of the experiment on a larger scale is needed to fully evaluate the merits of faster travel.

3. A test of oils as Ribicides. This study was suggested by and conducted in cooperation with the chemical investigation project. Its purpose was to test in the field on a comparatively large scale the lethality of various oils to Ribes, as a leaf spray and as a stem and crown application. In chart 6 is shown the locations, type of application, and kind of oil used in the experiments.

In spraying an oil on the leaves of Ribes the standard knapsack and double-action pump outfit developed by the Idaho eradication operation was used. Both upper and lower surfaces of all leaves as well as all exposed stems were coated with oil.

In the application of oil to exposed crowns on areas 1 and 2 the oil was sprayed on the protruding crown after all live stem had been cut away. On area 3 crown applications consisted of spraying the oil to the crown and around the roots without cutting away the tops of the bushes.

In applying to lacerated tops the oil was sprayed on the stems after they had been considerably bruised and broken with a brush hook.

Final results as to the effectiveness of oils as Ribicides will not be known until examinations are made in 1931.

Before the end of the 1930 season considerable sprouting, and in some instances the formation of new leaves on sprayed stems, was noted on pitch oil leaf-spray plots. Where Diesel oil was used as a leaf spray

TABLE NO. 13

EFFECT OF SPEED ON CREW WORK

Crew Speed	Ribes eradicated	R.L.S. eradicated	Ribes missed	R.L.S. missed	Working Time
Fast	382	5,340	83	270	1 hr. 30 min.
Average	225	5,040	73	150	2 hrs. 05 min.
Slow	420	5,133	35	54	3 hrs. 10 min.

This experiment is not of sufficient size to permit definite conclusions. The results point towards a possibility of cost reductions by speeded-up searching time in tree work. However, speeded searching time results in lowered efficiency and this must be taken into consideration in reducing searching time. A repetition of the experiment on a larger scale is needed to fully evaluate the merits of faster travel.

3. A test of oils as silvicides. This study was suggested by and conducted in cooperation with the chemical investigation project. Its purpose was to test in the field on a comparatively large scale the lethality of various oils to Ribes, as a leaf spray and as a stem and crown application. In chart 5 is shown the locations, type of application, and kind of oil used in the experiments.

In spraying an oil on the leaves of Ribes the standard knapsack and double-action pump outfit developed by the Idaho eradication operation was used. Both upper and lower surfaces of all leaves as well as all exposed stems were coated with oil.

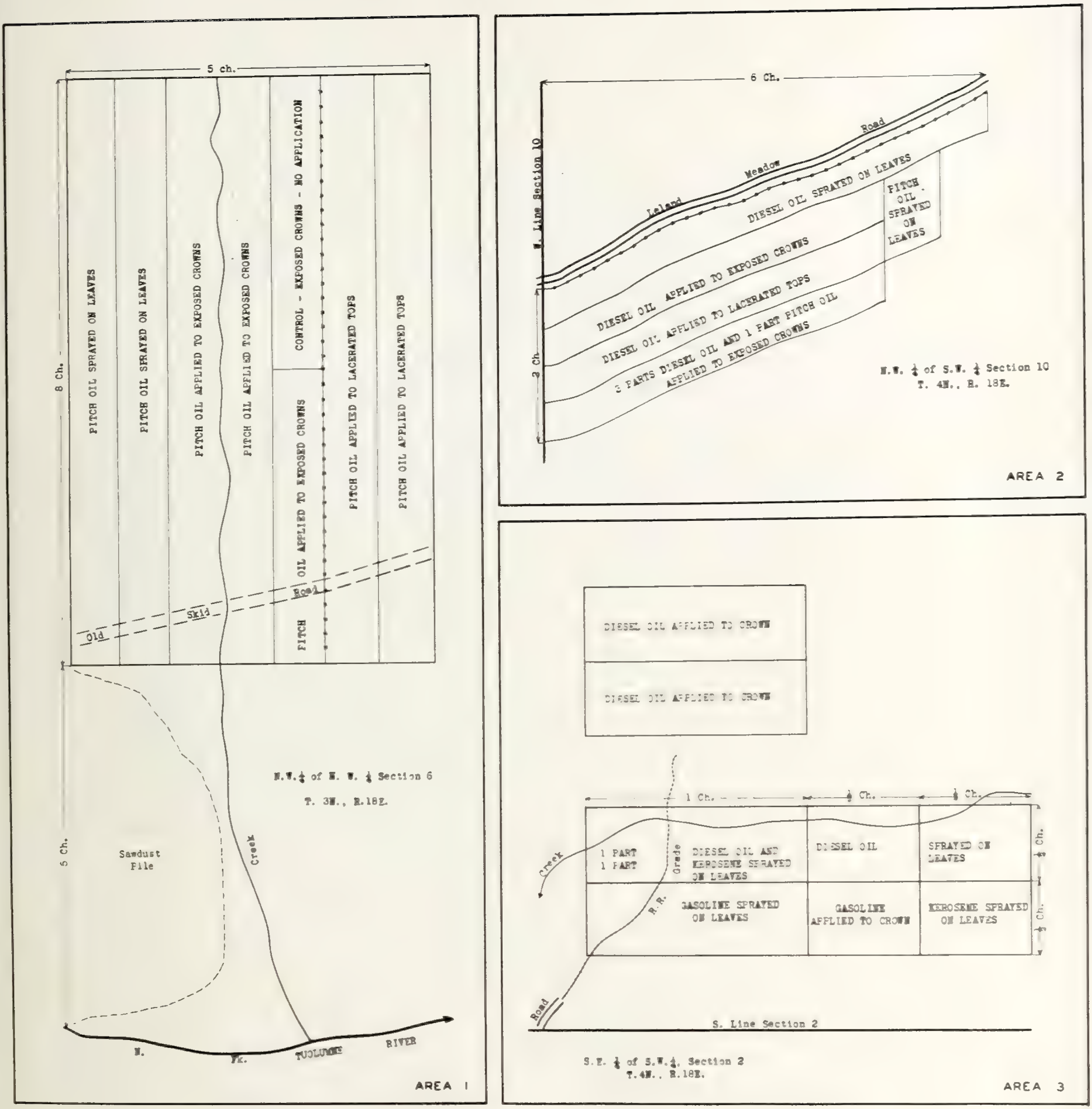
In the application of oil to exposed crowns of areas 1 and 2 the oil was sprayed on the protruding crown after all live stems had been cut away. On area 3 crown applications consisted of spraying the oil to the crown and around the roots without cutting away the tops of the bushes.

In applying to lacerated tops the oil was sprayed on the stems after they had been considerably bruised and broken with a brush hook.

Final results as to the effectiveness of oils as silvicides will not be known until examinations are made in 1931.

Before the end of the 1930 season considerable sprouting, and in some instances the formation of new leaves on sprayed stems, was noted on pine oil leaf-spray plots. Where diesel oil was used as a leaf spray

CHART 6



OIL APPLICATION AREAS

1930 Annual Report
W. V. Benedict

no sprouting or re-leafing was noted at the close of the 19[illegible] season. No re-growth was noted on other plots.

4. <u>A study to determine the efficacy of using oils in eradication work.</u> Should oils prove sufficiently lethal to Ribes to warrant their use as Ribicides, would their use be less expensive than present grubbing methods? What are the limitations on the use of oil with reference to Ribes conditions and working conditions? To get an answer to these questions the following experiment was undertaken:

Five plots were laid out in different representative areas of heavy Ribes. A 3-man crew, each man equipped with standard knapsack and spray pump outfit (with special small orifice on pump to permit full atomization of oil), was sent over each plot to spray all Ribes. Spray was applied liberally to leaves and stems. Individual string guide lines were laid out in advance of spraying. Diesel oil was used because of its availability and inexpensiveness. After the spraying job was completed a 3-man grubbing crew went over the plot and grubbed out all Ribes.

TABLE NO. 14

OIL SPRAYING EXPERIMENT

Plot No.	Acres	Number Ribes on Plot	Feet Live Stem on Plot	Number Ribes Per Acre on Plot	Feet Live Stem Per Acre on Plot	Man-Days to Spray	Gallons of Oil Used	Man-Days to Grub	Cost Per Acre For Spraying	Cost Per Acre For Grubbing
1	3.8	557	15,876	147	4,178	3.0	78	2.13	$7.45	$3.46
2	3.8	764	15,594	201	4,103	1.75	52	2.63	4.56	4.28
3	7.0	921	16,934	131	2,424	2.63	63	4.0	3.45	3.53
4	16.5	5,017	87,804	304	5,321	11.6	276	13.1	6.44	4.91
5*	6.0	2,066	41,320	344	6,887	3.0	83	7.0	4.83	7.21
Total	37.1	9,325	177,528	251	4,785	21.98	552	28.86	$5.53	$5.08

* An area of large old bushes; other areas contained young bushes.

One gallon of oil was used on each 17 bushes, or one gallon of oil for 322 feet of live stem, or 1/2 pint of oil per 20 feet of live stem.

Table 14 shows the results of the 5 experiments. In computing costs per acre Diesel oil was figured at 8¢ per gallon (the wholesale cost at Sonora, California) and transportation of oil was charged against spraying costs as incurred. No charge was made for spraying equipment.

The results of these experiments indicate that the employment of oils as sprays in California, aside from considerations of their toxicity as ribicides will likely be limited. Their field of use may be widened by reductions in the cost and transportation of oil, and by further experience in their application. Transportation costs incurred in the experiments were minimum since all plots were located contiguous to automobile roads.

Bushes that have been sprayed with either Diesel oil or pitch oil will burn readily 2 months after spraying, and recently sprayed areas are highly inflammable. The danger of fire is therefore a factor to be considered in the employment of oils.

Injections of oils or chemicals into stems and crowns of Ribes may prove more desirable than oil sprays to aerial parts of the plants. Such experiments are being undertaken by the chemical investigations project.

5. A summary of Ribes eradication work on small unworked area between the 1926 and 1927 experimental eradication areas. This area (see cross-hatched area on map) was a part of the original 1927 experimental eradication unit. It was not worked in 1927 because of interference by logging operations. The summarized results of eradication on the area are shown in table 15.

TABLE NO. 15

SUMMARY OF ERADICATION

Cut-over Type	Acres	Man-Days	Ribes Eradicated: R. roezli	R. nevadense	Total	Average Number Per Acre	Cost Per Acre
S.P.-F.	175	65	20,888	2,757	* 23,645	135	$2.30
Stream	10	10	3,077	9,911	**12,988	1,299	6.18
Total	185	75	23,965	12,668	36,633	198	$2.51

*In sugar pine-fir type 87.7 per cent of Ribes were seedlings originating since 1927.

**In stream type 95.0 per cent of Ribes were seedlings originating since 1927.

Table 16 shows a comparison of costs and ribes per acre for this area with a similar adjoining area reworked this season, and on which an eradication was performed just before logging.

TABLE No. 16

RELATION OF TIME OF ERADICATION TO LOGGING WITH RESPECT TO RIBES ESTABLISHMENT AND COSTS ON SUGAR PINE-FIR AND STREAM TYPES

Area*	Time of Eradication	S.P.-Fir Type			Stream Type			Average		
		Acres	Ribes Per Acre	Costs Per Acre	Acres	Ribes Per Acre	Costs Per Acre	Acres	Ribes Per Acre	Costs Per Acre
No. 1	Just before logging)	169	61	$2.22	35	90	$3.85	204	66	$2.60
	Reworked 3 years later)	-	87	1.69	-	563	3.69	-	168	2.03
	Total for area	169	148	$3.91	35	653	$7.54	204	235	$4.63
No. 2	First eradication 3 years after logging	175	135	$2.30	10	1,299	$6.18	185	198	$2.51

*Area No. 1 - Ribes eradicated in 1927, reworked in 1930.
*Area No. 2 - Ribes eradicated in 1930, no rework.

In every case it is seen that the per acre costs for area No. 2, where one eradication followed logging, are lower than the combined costs of eradication and re-eradication for area No. 1. The average number of Ribes per acre is less on area No. 2 than on area No. 1, although there is a greater number in the stream type of area No. 2. While no sweeping conclusions can be drawn from this comparison, these data indicate that an eradication operation should be delayed until after logging. However, a comparison of subsequent eradications on both areas is essential to a complete understanding of the most advantageous time of eradication.

On the basis of present findings, eradication, to be most effective, should take place sufficiently long after logging to permit complete seedling establishment, but before heavy fruiting starts probably 3 or 4 years after logging.

6. Recheck of Forest Service experimental logging areas. Ribes studies were made on these plots in May 1929, at which time all Ribes found on each plot were eradicated. The area on which the plots are located was covered by eradication crews in 1926. (See 1929 annual report for full particulars concerning these plots.)

In August 1930 the second re-eradication survey was made. Table 17 shows the results of this, the second reworking. Subsequent Ribes surveys are planned on these plots. No definite conclusions can be drawn from these studies for several years.

TABLE NO. 17

RIBES RE-ERADICATION, LOGGING AND MILL STUDY PLOTS, STANISLAUS FOREST, CALIFORNIA.
BUSHES PLOTTED BUT NOT ERADICATED

Plot	Seedlings						Sprouts		Missed						Total Bushes for Plot						Acres
	R. roezli		R. nev.		Total		R. roezli		R. roezli		R. nev.		Total		R. roezli		R. nev.		Total		in
No.	Bu.	F.L.S.	Bu.	F.L.S.	Bu.	F.L.S.	Bu.	F.L.S.	Bu.	F.L.S.	Bu.	F.L.S.	Bu.	F.L.S.	Bu.	F.L.S.	Bu.	F.L.S.	Bu.	F.L.S.	Plot
11*	351	105.1	7	2.6	358	107.7	4	1.2	29	74.4	1	1.0	30	75.4	384	180.7	8	3.6	392	184.3	15
10	131	51.6	43	12.9	174	64.5	1	6.5	47	139.6	18	43.3	65	182.9	179	197.7	61	56.2	240	253.9	15
9	1	.4	-	-	1	.4	1	12.0	2	15.5	-	-	2	15.5	4	27.9	-	-	4	27.9	15
Total	483	157.1	50	15.5	533	172.6	6	19.7	78	229.5	19	44.3	97	273.8	567	406.3	69	59.8	636	466.1	45

*No. 11, heavily logged; No. 10, economic cutting, No. 9, Forest Service cutting.

CONTROL RECONNAISSANCE ON THE ELDORADO NATIONAL FOREST, CALIFORNIA, 1930

By
D. R. Miller,
Junior Forester

PURPOSE

The performance of control reconnaissance on the Eldorado National Forest during 1930 was a continuation of the original purpose of the project, to secure a systematic survey of the commercial sugar pine belt of California in order to determine the Ribes and sugar pine conditions existing therein and their relation to the spread of the white pine blister rust. This survey provides a basis upon which approximate costs can be computed for protecting sugar pine areas against blister rust.

LOCATION OF THE WORK

A. Reason for Selection

The Eldorado National Forest was selected because of the advisability of conducting reconnaissance in the gap between the Plumas National Forest on the north and the Stanislaus National Forest on the south on which areas work had already been done. The Eldorado supports good stands of sugar pine in its optimum range. The small amount of sugar pine on the Tahoe Forest immediately north of the Eldorado eliminated this forest from present consideration.

B. General Description

The Eldorado National Forest lies on the west slope of the Sierra Nevada south and west of Lake Tahoe between townships 7 and 14 north and ranges 10 and 19 east, Mt. Diablo Base Line Meridian. Many streams traverse the forest from east to west dividing it into a series of canyons and ridges. Beginning at the southern end and progressing north, the principal ones are: the Middle and South Forks of the Cosumnes River, the Silver and South Forks of the American River, Silver Creek, the Little South Fork of the Rubicon, the Rubicon, Long and Wallace canyons, and at the extreme northern end of the forest, the Middle Fork of the American River. The high ridges separating these rivers have thus far prevented the establishment of a complete north and south road system, so that the use of a pack train was required to gain access to some sections.

Placerville, the headquarters of the forest which is situated at its western boundary, was the temporary headquarters of and the base of supplies for the reconnaissance camp.

The sugar pine stands are found at elevations of 4,000 to 6,500 feet. In association with sugar pine occur the other timber species of the region, namely: western yellow pine (Pinus ponderosa), Jeffrey pine (P. jeffreyi), white fir (Abies concolor), red fir (A. magnifica), Douglas fir (Pseudotsuga taxifolia) and incense cedar (Libocedrus decurrens). Sugar pine is not evenly distributed within the forest, but exhibits a spotted distribution, being usually found in belts or zones. Its volume per acre is represented to a great extent by one or two large, well developed trees, which condition further emphasizes the scattered nature of the pine of this region. A moderate amount of reproduction is present.

Four species of Ribes are native to the sugar pine stands. In the order of their abundance they are: Ribes roezli, R. nevadense, R. viscosissimum and R. cereum. R. nevadense inhabits stream bottoms and moist sites, while R. roezli is found on all sites. R. viscosissimum occurs on the higher ridges, and R. cereum on the dry sites bordering lodgepole pine flats and within yellow pine types; neither of these species is abundant.

As a general rule, heavy brush characterizes the areas worked. The principal genera are Arctostaphyllos, Ceanothus, Cornus, Prunus, Quercus, Acer, Alnus and Salix.

C. Detailed Location

There are four major areas within the forest supporting the best sugar pine stands, and on which reconnaissance was conducted. Brief descriptions of these follow:

1. The North Fork of the Cosumnes River and Cat Creek division on the southern edge of the forest consists of two adjoining valleys including about 28 sections. The Cat Creek portion supports an excellent stand of mature sugar pine, while the northern part of the unit supports only a scattered and mediocre stand. A large part of the land is owned by the California Door Company.

2. The Alder Creek, Silver Fork and American River division lying north of the first and consisting of some 70 sections, has belts of good sugar pine throughout, excepting the north side of the American River canyon. The Silver Fork portion contains excellent sugar pine accessible at present by pack train only. The California Door Company is the largest timber owner.

3. Between the South Fork of the American River and the Rubicon River lies the Ice House and Silver Creek unit which has the largest and best stands of sugar pine found on the forest. Excellent mature pine forming from 60 per cent to 80 per cent of the stand is found on several entire sections. There is good reproduction throughout. Parts of the area are

rough, but as a whole it is less rugged than the other units, and is traversed by several roads. The 68 sections embracing the area are largely in the ownership of the Michigan California Lumber Company.

4. The Rubicon unit, a series of deep canyons on the northern border of the forest between the Rubicon River and the Middle Fork of the American River, is the smallest and poorest unit worked. Pack trains were used here exclusively since roads are non-existent. Small patches and belts of sugar pine are intermingled with large brush fields. Small owners control the larger part of the timber.

METHODS OF WORK

A. Mechanical Procedure

The mechanical methods of reconnaissance were the same as those employed during the previous three seasons, which are fully described in the Blister Rust Report for 1927. However, a few changes were made. First, Ribes data were taken in all large draws and dry stream beds, as well as along the streams themselves. Second, a minimum width of one-half chain for stream type on each side of the stream was adopted in order that the acreage of this type shown by reconnaissance data might more nearly conform to that obtained on actual eradication operations. Third, more emphasis was laid on the Ribes count on the plots in an effort to obtain a figure more representative of the true Ribes population. Fourth, the timber species were listed in the column headed "Over-Story" on the data sheets in the order of their predominance by volume in the locality of each timber plot. This was done at the suggestion of the Forest Service of Region 5, the data to be used by them in the preparation of a timber type map. Fifth, when beginning a strip, the first Ribes plot was started at a distance of one chain from the section line and extending four chains in the direction of the strip instead of starting five chains from the section line. This was done to avoid the possibility of the last plot on the strip extending into the next section in case of error in pacing.

B. Eradication Types

The composition of the forest varied so frequently and so gradually that at times it was very difficult to classify a stand according to eradication types. The standard eradication types are: sugar pine-yellow pine usually occurring in mature stands (SP-YP Mat.), sugar pine-fir in mixed age classes (SP-F Mix), stream type (Stream) cut-over types for the same (SP-YP CO, SP-F CO, Stream CO), brush, meadow and minor types. Minor types include all the various non-sugar pine timber types not included in the above, such as pure yellow pine, yellow pine in association with other species, and numerous fir types. These were mapped separately upon the field sheets to aid the Forest Service with their type map, but were consolidated under "Minor Types" when the office computations were made.

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C. Personnel

The field supervisor, D. R. Miller, six assistants and a cook, composed the field personnel of the project. Compilations of data were made by T. V. Benedict and T. H. Harris, map work by F. F. Staat.

WORK PERFORMED AND RESULTS OBTAINED

Tables giving the results of reconnaissance on the Eldorado National Forest follow. Ribes analysis by localities was abandoned since there were no wide differences in data between sections of the forest. Instead, a summary for all areas covered is given in Table No. 2.

TABLE NO. 1

SECTIONS WORKED IN WHOLE OR IN PART.
RECONNAISSANCE, ELDORADO NATIONAL FOREST, CALIFORNIA, 1930

T.	R.	Sections by Number	Totals	
			Sec.	Acres
8N	15E	3	1	640
9N	14E	1-5, 11, 12, 14, 15, 24	10	6,400
9N	15E	7, 8, 10, 15-23, 27-29, 32-35	19	12,160
10N	10E	6	1	1,280
10N	15E	1, 5-9, 12, 15-29	22	13,462
10N	16E	3-5, 7-9, 16-22, 27-30, 32-34	20	14,364
11N	14E	1, 3-5, 7-10, 12-17	14	8,000
11N	15E	20-23, 26-29, 31-34	12	7,128
11N	16E	19-30	12	7,680
12N	13E	1, 11-16, 20-28, 35	17	10,560
12N	14E	5-10, 13, 16-21, 23-25, 29, 30, 32, 33	20	11,200
12N	15E	17, 19, 20, 30	4	2,560
13N	13E	1, 2, 4, 10, 11, 14-23, 25, 27-31, 36, 36	23	12,208
13N	14E	10, 11, 13, 14, 21-24, 27-32	14	8,000
14N	13E	13, 14, 22-28, 34	10	6,400
14N	14E	18	1	640
Totals			200	122,852

TABLE No. 2

ACREAGE AND RIBES ANALYSIS OF AREA RECONNAISSANCED ELDORADO NATIONAL FOREST

Eradication Types		Acres	Per Cent of Total	Ribes per Acre					Per Cent of Total*
				R. roezli	R. nevadense	R. viscosissimum	R. cereum	Totals	
Sugar Pine Types	SP-YP Mixture	37,493	[illegible]	34.1	1.7	0.02	0.08	35.9	11.4
	SP-Fir Mixed	44,378	36.2	125.5	11.5	4.1	1.5	143.6	53.9
	SP-YP CO	380	0.3	5.4	-	-	-	5.4	0.02
	SP-Fir CO	283	0.2	12.4	-	-	-	12.4	0.02
	Totals	82,533	67.2	83.9	6.9	2.3	0.8	93.9	65.4
Associated Types	Stream	5,399	4.4	118.4	95.6	2.7	0.9	217.6	9.9
	Brush	6,477	5.3	79.6	2.7	-	3.8	85.9	2.2
	Meadow	347	0.3	29.8	-	-	-	29.8	0.1
	Minor Types	28,006	22.8	70.5	2.5	5.4	[illegible]	84.7	22.4
	Totals	34,730	[illegible]	[illegible]	17.1	4.7	6.4	117.9	34.6
Grand Totals		122,682	100.0	81.9	9.3	2.8	2.9	95.6	100.0

*Percentage of total Ribes on the whole area covered.

STATEMENT AND ANALYSIS OF COSTS

TABLE NO. 3

CONTROL RECONNAISSANCE COSTS ELDORADO NATIONAL FOREST, CALIFORNIA, 1930

Classification	Cost	Percentage of Total
Supervision and Labor		
Supervision, salary and expenses	$ 889.07	22.5
Salaries of assistants	1,726.66	43.6
Totals	2,615.73	66.1
Subsistence*		
Cost of food	518.48	13.1
Transportation of food	80.05	2.0
Cook's salary	270.00	6.8
Totals	868.53	21.9
Transportation		
Transportation of men	88.29	2.2
Miscellaneous travel	46.07	1.2
Scouting	107.04	2.7
Totals	241.40	6.1
Equipment		
Cost of equipment	73.61	1.9
Transportation of equipment**	130.19	3.3
Storage of equipment	12.73	0.3
Totals	216.53	5.5
Miscellaneous expenses	13.88	0.4
Grand Total	$3,956.07	100.0

*Number of meals served. 2,182
Cost per meal..... ....$.404

**Includes $72.00 pack train hire.

The cost per acre was $.0322 obtained by dividing the total cost of reconnaissance by the number of acres covered.

PART I

INVESTIGATIVE WORK IN THE CHEMICAL ERADICATION OF RIBES

By

H. R. Offord

Agent

INTRODUCTION

Further laboratory and field experiments have been undertaken to determine the killing action of various chemicals on Ribes. Laboratory work has been done as in previous years at the University of California and has comprised chemical, morphological and physiological experiments, primarily on Ribes petiolare, R. inerme, R. viscosissimum and R. lacustre. These laboratory investigations have been used as the basis for additional field experimentation conducted during the 1930 field season. In Idaho, R. petiolare, R. inerme, R. viscosissimum and R. lacustre were subjected to additional experimentation and in California, R. inerme, R. roezli and R. nevadense were further studied. The work in Oregon included additional experiments on R. bracteosum, R. lacustre, R. watsonianum and R. sanguineum. Experiments were made this year for the first time on R. hallii and R. erythrocarpum in the Crater Lake region.

A brief summary of research work conducted at Berkeley during the period September 1929 to May 1930 is given in this report primarily as an introduction to field experiments. For complete information on the various chemical and morphological investigations reference should be made to special reports and papers prepared for office reference or for publication.

Field experiments reported herein for 1930 include applications of chemicals to aerial parts, (1) as an aqueous spray, (2) dissolved in or added to an oil; to stems, (1) as an aqueous solution applied to a scarified surface, (2) in the form of a paste packed into incision; and to crowns, (1) as an aqueous solution applied to a scarified surface, (2) as an aqueous solution injected into holes bored by means of a twist drill, and (3) as a water paste packed into V-shaped grooves.

A consideration of all research work performed to date and a review of field experiments carried out at the suggestion of that research work showed the advisability of investigating methods of chemical treatment other than the established spraying method. Experiments were planned therefore to consider possible penetration of chemicals through roots, through crowns and through aerial stems.

SUMMARY OF RESEARCH WORK 1929 - 1930

A. Propagation of Ribes Under Greenhouse Conditions

A satisfactory technique has been worked out for growing Ribes in sand culture and water culture. For the former method a light sandy soil containing a high percentage of leaf mold or peat is used. The water culture method, however, is more convenient for rapid propagation of experimental material provided that it is not necessary to hold plants in this medium for too long a period. This method has been used almost exclusively during the past year. Quarter strength Hoagland culture solution is used for *R. petiolare*, half strength Hoagland for *R. inerme* and *R. lacustre*, and full strength Hoagland for *R. roezli* and *R. viscosissimum*. Full strength Hoagland solution has the following composition in parts per million:

NO_3 - 715, PO_4-105, SO_4-214, K-184, Ca-159, Mg-54.

Small quantities of boron, manganese, copper, zinc, etc., so-called A to Z solution, are added to the solution. About 5 c.c. ferric tartrate solution is added weekly to each 3-liter jar. The jars are wrapped in paper to exclude light and then placed in damp sphagnum moss to maintain the temperature of the culture solution at 18 degrees centigrade. Culture solutions are aerated twice a week to prevent accumulation of gases caused by decomposition of organic material. Artificial illumination is used during the short dark days. Solutions are replaced by freshly prepared ones every thirty days.

B. Chemical Work

The following investigations were undertaken during the period September, 1929 to May, 1930:

1. Starch analysis of leaves, stems and roots of *R. petiolare, R. inerme, R. lacustre and R. viscosissimum*. Results of 196 determinations confirm earlier field observations made by Crafts that *R. petiolare* maintains a lower starch reserve throughout the entire growing season than do the more resistant species. This work will be the subject of a special report giving results in detail.

Starch determination of other Ribes are planned for the year according to the working plan given at the conclusion of this report.

2. The reaction of starch-sodium chlorate mixtures under the influence of ultra violet light. Exposure of acid and neutral solutions of sodium chlorate in quartz tubes to ultra violet light resulted in a decomposition of the sodium chlorate as evidenced by the subsequent oxidation of KI. Nitella cells immersed in .01 M. sodium chlorate solutions were

injured more rapidly when that solution was irradiated for 30 minutes with ultra violet light than control cells immersed in sodium chlorate without irradiation. Preliminary experiments on the oxidation of glucose alone and glucose plus sodium chlorate in neutral and alkali media did not show large differences caused by the addition of sodium chlorate. If small differences are significant, however, a definite increase in oxidation occurs as the pH is changed from acid to alkaline. The interaction of tannin on these same mixtures, in the presence of takadiastase showed a trend in favor of the protective action of tannins. No definite conclusions can be drawn from these experiments and further experimentation in the field should await direct leads secured from physiological studies of the effect of chlorates on respiration, transpiration and photosynthesis. These latter studies are suggested in the working plan for the winter of 1930-31.

3. <u>The effect of sodium chlorate on respiration</u>. In the first series of experiments equal weights of freshly cut potato tubers were treated as follows:

a. Control. Cut tubers. No treatment.

b. Cut tubers soaked in KCl M/10 (nontoxic) for 15 min.

c. " " " " $NaClO_3$ M/10 (toxic) for 15 min.

d. " " " " " " " 30 min.

Samples of cut tubers were then put into respiration jars and left in an incubator at 26° C. over periods of 24 and 48 hours. Subsequent analysis showed that production of CO_2 from chlorate treated tubers exceeded that of the control but was not of sufficient magnitude to be significant. A more critical type of apparatus was devised which absorbed the CO_2 produced from tubers immersed in chlorate solution in tall columns filled with $Ba(OH)_2$. Results were not consistent even with this improved apparatus. Finally an apparatus was devised of the type suggested by Osterhout which measured the amount of CO_2 produced by the changes in color of an indicator solution. Fresh extracts of potato tubers were used as a source of oxidase in this latter experiment and the oxidation of glucose was studied. The presence of traces of phosphate in the potato extract finally prevented a significant measurement of the resultant effect when more phosphate was added and experiments were left at this point. Apparently the effect of sodium chlorate on respiration cannot be resolved into a simple oxidation of glucose for the purposes of laboratory study. It is planned to make further studies along this line during the coming winter.

4. The study of the toxic action of dilute sodium chlorate solution on Nitella. The importance of pH on the toxic action of buffered solutions of sodium chlorate on Nitella was studied in a series of critical experiments. A comparison was also made between sodium chlorate and sodium nitrate as a basis for establishing the fundamental toxicity of the chlorate. Results of these experiments showed the increased effectiveness of sodium chlorate in slightly acid solutions and further confirmed the toxicity of the chlorate ion. Results of these experiments are now being prepared for publication.

5. Complex salts of heavy metals. On the basis of non-reactivity with plant extractives typical complex compounds were prepared of the following classes of chemical compounds:

a. Non-electrolytes

b. Electrolytes (binary, ternary and quaternary)

Aqueous sprays of complex salts of heavy metals have not proved to be fully effective on the resistant Ribes and later work has centered about a heavy metal complex soluble in oil but preferentially soluble in water. However, the extreme rapidity with which complex salts move through the vessel elements has suggested that injection may be a more fruitful field for their use than contact sprays. These two lines of investigation will be pursued further in subsequent research work.

6. Complex compounds of selenium, chromium, copper and cobalt were tested as sprays in aqueous solution. Various oils, notably pitch oil and emulsions of these oils containing chlorate, sodium selenate, copper complex, etc., were also tested by spray application to greenhouse Ribes. In addition to these sprays, zinc, ammonium chloride and sodium chlorate containing varying small percentages of osmic acid were given similar tests. A series of hygroscopic dusts prepared by mixing copper complex with magnesium chloride and calcium chloride to which gypsum and kaolin had been added as a dilutent were also tested in the greenhouse. Those which showed possibility for field use are described later in this report under field experiments.

C. Morphological Work.

A detailed report covering morphological work undertaken during the past 18 months has been prepared by Dr. Webber. A summary is herein presented of the morphological data most significant in regard to susceptibility of Ribes to chemical treatment.

1. Herbage production:

a. Leaf size. R. petiolare, R. viscosissimum, R. inerme, R. lacustre, arranged in decreasing order.

b. Length and basal diameter of current season's shoots. R. petiolare, R. viscosissimum, R. inerme, R. lacustre, arranged in decreasing order.

2. Epidermal characters:

a. Stomatal number. R. petiolare, R. viscosissimum, R. inerme, R. lacustre, arranged in decreasing order.
b. Hydathode number per leaf tooth. R. petiolare and R. viscosissimum 2 - 5 and R. inerme and R. lacustre 1 - 3 hydathodes per leaf tooth. R. petiolare has also the greatest number of teeth per leaf blade.

3. Palisade Ratio:

R. petiolare, R. viscosissimum, R. inerme and R. lacustre arranged in decreasing order.

4. Size of leaf blade vascular bundle:

R. petiolare, R. viscosissimum, R. inerme and R. lacustre arranged in decreasing order.

5. Thickness of upper and lower epidermal cells.

R. petiolare and R. viscosissimum usually have thinner outer walls than R. inerme and R. lacustre.

6. Texture, size and number per unit area of xylem elements in old stems. R. petiolare, R. viscosissimum, R. inerme, R. lacustre arranged in decreasing order in regard to potential conduction in light of these factors.

Examination of the above series of morphological data shows that the four Ribes species in all cases fall into the same order with respect to one another. This order arranges the Ribes in the previously determined order of susceptibility to chemicals. It might be noted that the morphological data show R. lacustre to be slightly more resistant to chemicals than R. inerme if the end position in this scale is considered for the moment to be significant. R. lacustre is similarly placed at the most resistant end of the list by chemical data, though in field experiments R. inerme has appeared to be most resistant.

R. lacustre and R. inerme, however, are close together in this scale of susceptibility. The most significant division comes between R. petiolare and R. viscosissimum on the one hand and between R. inerme and R. lacustre on the other. This division is corroborated by chemical and morphological data and also by the results of field experiment.

D. Application of Research Work and Greenhouse Tests to Field Experiments.

Laboratory investigations and greenhouse tests undertaken at Berkeley suggested field experiments as follows:

1. The use of buffered sodium chlorate and Atlacide sprays in place of sprays merely adjusted with dilute acid or alkali.

2. The use of copper complex as a crown or stem injection.

3. Pitch oil, Diesel oil and Edleanu extract containing as a solute varying amounts of furfural, pyridene, benzene, toluene and naphthalene.

4. The use of zinc ammonium chloride as a crown application to Berberis vulgaris and R. inerme.

SUMMARY OF 1930 FIELD EXPERIMENTS

A. Recheck of 1929 Experiments in Idaho, California and Oregon.

Experimental plots at Santa, Idaho were checked by A. Bickford and subsequently by the writer according to the established method of ocular estimates. Table 1 summarizes these data. Plots at Gooseberry Camp and Leland Meadow, California, were checked by d'Urbal and Quick; results are reported in Table 2. Oregon work for 1929, checked by d'Urbal, Holaday and the writer in July and August of 1930, is reported in Tables 3 and 4.

TABLE NO. 1

RESULTS OF 1929 EXPERIMENTAL SPRAYING AT SANTA, IDAHO. DATA TAKEN IN 1930.

Date of Application	Plot Number	Chemical	Concentration Pounds Per Gallon H_2O	pH of Spray	Gallons Spray Used	At Time of Application: Average Soil Temp. 7:30 a.m. to 5 p.m. Degrees F.	At Time of Application: Average Relative Humidity 7:30 a.m. to 5 p.m.	At Time of Application: Weather Log	R. inerme: Live Stem Killed Per Cent	R. inerme: Bushes Killed Per Cent	R. inerme: Bushes Treated Number
7/2/29	XI A (0-1)	A (1) + Magnesium chloride	2.70 1.50	6.5	2.0	55	37	Warm. Clear.	74	14	35
7/8/29	XI A (1-1.6)	A + Magnesium chloride	2.70 1.50	8.0	2.0	56	59	Warm. Clear.	85	0	9
7/8/29	XI A (1.6-2)	A + Magnesium chloride	2.70 1.50	4.0	2.0	56	59	Warm. Clear.	97	40	10
7/8/29	XI A (2-2.5)	A + Magnesium chloride	2.70 0.75	8.0	3.5	56	59	Warm. Clear.	93	50	18
7/9/29	XI B (1-2.2)	Y (2)	3.54	6.5	5.0	57	48	Warm. Clear.	74	3	34
7/9/29	XI B (2.2-3)	Y (3)	3.54	6.5	5.0	57	48	Warm. Clear.	64	18	22
7/10/29	XI A (2.5-3)	A + Magnesium chloride	2.70 0.75	4.0	6.0	60	44	Warm. Clear.	90	44	41
7/10/29	XI A (3-3.6)	A + Magnesium chloride	2.70 0.75	6.5	3.0	60	44	Warm. Clear.	92	33	9
7/11/29	XI A (3.6-4)	A + Magnesium chloride	2.70 0.38	8.0	3.0	57	48	Warm. Cloudy.	93	31	16
7/11/29	XI B (3-3.5)	A + Magnesium chloride	2.70 0.38	6.5	2.0	57	48		100	100	5
7/11/29	XI B (3.5-4)	A + Magnesium chloride	2.70 0.38	4.0	4.0	57	48	Warm. Cloudy.	96	77	13
7/12/29	XI B (0-1)	A + Magnesium chloride	2.70 0.19	8.0	2.0	55	43	Warm. Cloudy.	90	25	8
7/12/29	XI A (4-4.5)	A + Magnesium chloride	2.70 0.19	4.0	3.0	55	43	Warm. Cloudy.	96	65	20
7/12/29	XI A (4.5-5)	A + Magnesium chloride	2.70 0.19	6.5	4.0	55	43	Warm. Cloudy.	95	67	9
7/13/29	XI A (5-5.5)	Y (2) + Magnesium chloride	2.88 0.19	6.5	5.0	59	38	Warm. Clear.	86	24	25
7/15/29	XI B (4-4.4) XI A (5.5-6)	Y (2) + Glue + Glycerine	3.54	6.5	5.0				75	35	20
7/17/29	XI B (4.4-5)	X (4) + Molasses	1.40	6.5	5.0	66	30	Hot. Clear.	75	19	26
7/17/29	XI B (5-6)	X + Molasses	2.00	6.5	5.0	66	30	Hot. Clear.	62	3	30
7/18/29	X B (0-.4)	X + Molasses	2.70	6.5	5.0	65	39	Hot. Clear.	73	33	12
7/18/29	X B (.4-1)	X + Molasses	3.40	6.5	5.0	65	39	Hot. Clear.	79	12	24
7/22/29	X B (1-1.5)	X + Glue	2.70	6.5	5.0	59	34	Warm. Clear.	62	19	21
7/22/29	Ex. 1	X + Molasses	2.70	6.5	5.0	65	27	Warm. Clear.	50	0	10
7/23/29	Ex. 2	X + Glycerine	2.70	6.5	5.0	56	24	Warm. Clear.	60	0	10
7/23/29	XII A (0-.05)	X + Molasses	2.70	6.5	5.0	60	35	Warm. Clear.	65	12	8
7/25/29	XII A (.05-.1)	X + Molasses	2.70	6.5	5.0			Warm. Clear			
7/26/29	XII A (.1-.2)	X + Sodium thiosulphate	0.42 4.12		5.0			Warm. Clear.	72	15	13
7/26/29	XII A (.2-.3)	X + Sodium thiosulphate	0.89 4.12		5.0			Warm. Clear.	46	0	10
8/8/29	X B (1.5-2)	X + Sodium thiosulphate	2.00 2.06		5.0	59	56	Warm. Clear.	64	8	13
8/8/29	Ex. 3	Sodium thiosulphate	4.12		4.0	59	30	Warm. Clear.	25	See text	
8/9/29	Ex. 4	Sodium thiosulphate	3.09		5.0	58	26	Warm. Clear.	25	"	"
8/9/29	Ex. 5	Sodium thiosulphate	2.06		4.0	58	26	Warm. Clear.	15	"	"
8/24/29	Ex. 6	X + Glue (5) + Glycerine	0.89	8.0	6.0				25	"	"
8/24/29	Ex. 7	X + Glue + Glycerine	1.40	8.0	5.0				25	"	"
8/24/29	Ex. 8	X + Glue + Glycerine	2.00	8.0	5.0				70	"	"
8/24/29	Ex. 9	X + Glue + Glycerine	2.70	8.0	5.0				70	"	"
9/3/29	Ex. 10	Magnesium chlorate	3.40		14.0				70	"	"
9/3/29	Ex. 11	X + Ammonium chloride	1.40 0.50		5.0				30	"	"
9/3/29	Ex. 12	X + Ammonium chloride	1.40 0.80		5.0				40	"	"
9/3/29	Ex. 13	X + Magnesium chloride	2.70 0.37	10.0	5.0				50	"	"
9/3/29	Ex. 14	X + Magnesium chloride	2.70 0.19	10.0	5.0				40	"	"

(1) Sodium chlorate.
(2) New complex series made in field (Cu 1 : S_2O_3 6 : CN 4).
(3) New complex series made in field (Cu 1 : S_2O_3 5 : CN 4).
(4) Standard complex furnished from quantity made in Spokane by H. R. Offord.
(5) Glue .02# per gallon water and glycerine .1 to .5# per gallon as sticker and binder.

TABLE NO. 2

RESULTS OF 1929 EXPERIMENTAL SPRAYING IN CALIFORNIA, DATA TAKEN 1930.

Date of Appli-cation	Plot Number	Chemical Used	Concen-tration Lbs. per Gal. H_2O	pH of Spray	Gal. Spray Used	At Time of Application: Average Soil Temp. 7 a.m. to 5 p.m. Deg. F.	At Time of Application: Average Relative Humidity	At Time of Application: Weather Log	R. roezli: Live Stem Killed Per Cent	R. roezli: Bushes Killed Per Cent	R. roezli: Bushes Treated Number	R. nevadense: Live Stem Killed Per Cent	R. nevadense: Bushes Killed Per Cent	R. nevadense: Bushes Treated Number	R. cereum: Live Stem Killed Per Cent	R. cereum: Bushes Killed Per Cent	R. cereum: Bushes Treated Number	R. inerme: Live Stem Killed Per Cent	R. inerme: Bushes Killed Per Cent	R. inerme: Bushes Treated Number
6/20/29	Gooseberry Camp S (3)	Y (1)	4.96	10.0	5		23	Warm. Clear.			0			0	82	0	3			0
6/22/29	I Aa Area I	Y (1)	3.54	6.5	5	56	21	Warm. Clear.			0			0	54	0	8			0
6/22/29	I Ab Area I	Y (1)	2.16	6.5	5	56	21	Warm. Clear.			0			0	34	0	3			0
6/22/29	I Ac Area I	Y (1)	1.41	6.5	5	56	21	Warm. Clear.			0			0	47	0	4			0
6/24/29	I Aa Area II	Y (2)	2.88	6.5	5	56	22	Warm. Clear.	53	0	24			0	49	0	4			0
6/24/29	I Ab Area II	Y (3)	3.54	6.5	5	56	22	Warm. Clear.	60	0	14			0	43	0	4			0
6/24/29	I Ac Area II	Y (3)	2.88	6.5	5	56	22	Warm. Clear.	64	0	28			0	54	0	4			0
6/24/29	I Ba Area II	Y (3)	2.88	6.5	5	56	22	Warm. Clear.	52	0	28			0	44	0	5			0
6/25/29	I Bb Area II	Y (2)	3.54	6.5	5	51	25	Warm. Clear.	75	13	15			0	54	0	2			0
6/25/29	2a Area II	X (4) + Molasses	2.40	6.5	5	51	25	Warm. Clear.	18	0	28	16	0	1	28	0	2			0
6/25/29	2b Area II	X + Glycerine (5)	2.70 0.04	6.5	5	51	25	Warm. Clear.	29	0	54			0	40	0	2			0
6/26/29	2c Area II	X + Glycerine	2.70 0.24	6.5	5	56	33	Warm. Clear.	30	0	35			0			0			0
6/26/29	2d Area II	X + Molasses (6) + Magnesium chloride	2.70 0.38	6.5	5	56	33	Warm. Clear.	30	0	24			0	23	0	1			0
6/26/29	2e Area II	X + Glue (7)	2.70	6.5	5	56	33	Warm. Clear.	30	0	31			0	21	0	2			0
6/26/29	2f Area II	X + Molasses + Sodium thiosulphate	2.40 2.09	6.5	5	56	33	Warm. Clear.	41	7	29			0	33	0	3			0
6/27/29	3a Area II	A (8) + Magnesium chloride	2.70 2.60	6.5	5	57	34	Warm. Clear.	Est. 50-75%	0	Plots 19-29 burned			0	Est. 50-75%	0	Plots burned 1929			0
6/27/29	3b Area II	A + Magnesium chloride	2.70 2.60	12.0	5	57	34	Warm. Clear.	Est. 50-75%	0	Plots 19-29 burned			0	Est. 50-75%	0	Plots burned 1929			0
7/3/29	Leland Meadow V A (1-1a)	X + Glycerine	3.57 0.08	6.5	5		40	Clear. Warm.			0	96	32	22			0			0
7/3/29	V A (1a-1b)	X + Glycerine	2.70 0.24	6.5	5		40	Clear. Warm.			0	96	23	17			0			0
7/3/29	IV A (0-.7)	X + Glycerine	2.40 0.20	6.5	5		40	Clear. Warm.			0	95	47	10			0			0
7/10/29	Meadow Valley I	X + Molasses	2.70 0.96	6.5	30		47	Clear and warm with cold morning and high humidity in early a.m.			0			0			0	15	0	(9)
7/12/29	II (A) 0	X + Glue + Glycerine	2.70 0.16	6.5	10		40	Clear and warm with cold morning and high humidity in early a.m.			0			0			0	20	0	(9)
7/12/29	II (A) I	X + Glue + Magnesium chloride	2.70 0.50	6.5	10		40	Clear and warm with cold morning and high humidity in early a.m.			0			0			0	30	0	(9)
7/15/29	III A (0-a)	Y (3) + Glycerine	2.16 0.20	6.5	10		46	Clear and warm with cold morning and high humidity in early a.m.			0			0			0	15	0	(9)
7/16/29	III B (0-a)	Y (3) + Glue + Glycerine	2.88 0.20	6.5	10		46	Clear and warm with cold morning and high humidity in early a.m.			0			0			0	15	0	(9)
7/16/29	IV A (0-a)	Y (3) + Glycerine	3.54 0.20	6.5	10		46	Clear and warm with cold morning and high humidity in early a.m.			0			0			0	50	0	(9)
7/16/29	IV A (a-b)	Y (3) + Glycerine	3.54 0.96	6.5	10		46	Clear and warm with cold morning and high humidity in early a.m.			0			0			0	10	0	(9)

(1) Complex series made in field (Cu 1 : S_2O_3 8 : CN 2).
(2) Complex series made in field (Cu 1 : S_2O_3 7 : CN 3).
(3) Complex series made in field (Cu 1 : S_2O_3 7 : CN 4).
(4) Standard complex from lot made in Spokane by H. R. Offord.
(5) Glycerine added as binder 0.1# per gallon water.
(6) Molasses added as a binder 0.2# per gallon water.
(7) Glue added as a sticker 0.02# per gallon water.
(8) Symbol for sodium chlorate.
(9) Kill extremely poor. Time not taken to make actual count bushes. Live stem kill estimated.

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TABLE NO. 3

RESULTS OF 1929 EXPERIMENTAL SPRAYING IN OREGON
DATA TAKEN 1930

						At Time of Application (1)				
Date of Application	Plot Number	Chemical Used	Concentration Lbs. per Gal. H_2O	pH of Spray	Gallons Used	Average Relative Humidity 7 a.m. to 5 p.m.	Weather Log (2)	Live Stem Killed Per Cent	Bushes Killed Per Cent	Bushes Treated Number
7/29/29	Still Creek I A (0-1)	X (3) + Glycerine	1.80	6.5	10	33	Clear. Warm.	Still Creek (6a) 10	0	12
7/30/29	I A (1-2)	X + Glycerine + Glue	2.40	6.5	10	45	Sultry. Cloudy.	39	0	13
7/30/29	I A (2-3)	X + Glycerine	2.70	6.5	10	45		20	0	16
7/30/29	I A (3-4)	X + Magnesium chloride	2.70 0.75	6.5	10	45		13	0	29
7/31/29	I B (2-3)	A (4) + Glue + Magnesium chloride	1.40 1.50	6.5	10	54	Sultry. Cloudy.	88	4	46
8/1/29	I B (3-4)	Y (5) + Glycerine + Glue	2.16	6.5	10	80	Foggy.	12	0	27
8/2/29	II A (0-1)	Y + Glycerine + Glue	2.88	6.5	10	75	Foggy in early a.m. Clear	33	0	37
8/2/29	II A (1-2)	Y + Glycerine + Glue	3.54	6.5	10	75	in p.m.	7	0	24
8/6/29	Loop Highway I A	X + Glycerine	2.40	6.5	5	42	Hot. Clear.	Loop Highway (6b) 20	0	9
8/6/29	II	X + Glycerine	2.70	6.5	5	42	Hot Clear.	27	0	16
8/7/29	I.B	Y + Glycerine	2.88	6.5	5	47	Hot. Clear.	30	0	7
8/7/29	III	Y + Glycerine	3.54	6.5	5	47	Hot. Clear.	34	0	18
8/8/29	IV A	A	1.40	6.8	5	37	Hot. Clear.	97	0	19
8/8/29	IV B	A + Glycerine + Sodium hydroxide	1.40 0.08		5	37	Hot. Clear.	93	4	26
8/13/29	Santiam River I	Y + Glycerine	2.88	6.5	5	23	Hot. Clear.	Santiam River (6c) 21	0	21
8/13/29	II	Y + Glycerine	3.54	6.5	5	23	Hot. Clear.	63	0	8
8/13/29	V	X + Glycerine	2.40	6.5	5	23	Hot. Clear.	34	0	7
8/13/29	VI	Y + Glycerine	3.54		5	23	Hot. Clear	26	0	7
8/13/29	III	A + Glycerine	1.40	6.5	5	23	Hot. Clear.	91	21	10
8/13/29	IV	A + Glycerine + Sodium hydroxide	1.40 0.08		5	23	Hot. Clear.	94	50	13
8/17/29	Mud Creek I	Y	2.88		5	34	Clear Warm.	Mud Creek (6d) 14	0	12
8/17/29	II	X	2.40	6.5	5	34	Clear. Warm.	12	0	30
8/17/29	III	Y + Glycerine + Glue	3.54	6.5	5	34	Clear. Warm.	8	0	66
8/17/29	IV	X + Glycerine + Glue	2.70	6.5	5	34	Clear. Warm.	6	0	47
8/17/29	V	A + Glycerine + Glue	1.40	6.5	5	34	Clear. Warm.	37	4	57
8/17/29	VI	A + Sodium hydroxide	1.40 0.08		5	34	Clear. Warm.	52	16	28

(1) Soil temperatures were not taken.
(2) Weather characterized by high early morning humidity throughout course of Oregon work.
(3) Standard complex furnished from quantity made at Spokane by H. R. Offord.
(4) Sodium chlorate.
(5) New complex series made in field (Cu 1 : S_2O_3 6 : CN 4).
(6) a. Still Creek (_R. bracteosum_). b. Loop Highway (_R. watsonianum_). c. Santiam River (_R. sanguineum_). d. Mud Creek (_R. triste_).

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TABLE NO. 4

COMPARISON OF FIRST AND SECOND APPLICATIONS OF SPRAYS TO R. BRACTEOSUM AND R. LACUSTRE, STILL CREEK AREA OREGON.

Date of Application	Plot Number	Chemical Used	Concentration Lbs. per Gal. H_2O	pH of Spray	Gallons Used	*R. bracteosum* Live Stem Kill 1929	*R. bracteosum* Bush Kill 1929	*R. bracteosum* Live Stem Kill 1930	*R. bracteosum* Bush Kill 1930	*R. lacustre* Live Stem Kill 1929	*R. lacustre* Bush Kill 1929	*R. lacustre* Live Stem Kill 1930	*R. lacustre* Bush Kill 1930
7/31/29	Area 11 I A (0-2)	$NaClO_3$ + $NaOH$	1.40 0.08		5	-	-	-	-	99	75	99	80
7/31/29	Area 11 I A (2-3)	$NaClO_3$	1.40	6.8	4	95	0	96	24	98	49	99	53

B. Discussion of Results Obtained from 1929 Experiments.

Idaho: The mixture of magnesium chloride and sodium chlorate applied in several concentrations on Plot XI resulted in a fire of spontaneous origin 11 days after application. Therefore the kill shown in Table No. 1 for these experiments represents the effect of an extremely hot burn plus the action of the chemical. The toxic action of X and Y copper complex sprays on R. inerme was unsatisfactory. It is evident that the complex compound is not stable enough under the influence of reactive plant constituents to permit translocation of the chemical into root tissue. None of the sprays tested in 1929 showed sufficient kill of R. inerme to be recommended for large scale application. The results of sprays applied to plot numbers 3-14 (see Table No. 1) were considered to be so poor as not to justify searching out crowns for a bush kill figure.

California: Reference to Table No. 2 shows that X and Y sprays were ineffective on R. nevadense, R. roezli and R. inerme (Meadow Valley). The addition of magnesium chloride to Y at Meadow Valley noticeably increased the live stem kill. Figures for R. nevadense at Leland Meadow should be considered in the light of the age of the bushes and highly shaded conditions under which they are growing. The application of a magnesium chloride and sodium chlorate mixture to R. roezli and R. cereum at Gooseberry Camp was followed by a fire of spontaneous origin similar to the one at Santa, Idaho. The fire at Gooseberry Camp was very light and occurred the morning after application of the spray, most of the chemical was washed off the bushes in extinguishing the fire. This accounts for the small injury to the California Ribes compared with the injury produced at Santa, Idaho. Data were retaken over the 1929 experimental plots in 1930 and compared with those taken in 1929. R. roezli's power of regeneration is shown by these data to be much greater than that of R. nevadense, a 50% bush kill for the former and 35% bush kill for the latter being representative of this difference. The effect of age or the general susceptibility of Ribes to chemical treatment is shown by the high kill obtained on R. nevadense at Leland Meadows.

Oregon: X and Y sprays were relatively ineffective on the following Oregon species: R. lacustre, R. bracteosum, R. triste, R. viscosissimum and R. sanguineum. Injury appears to increase with concentration of the X or Y spray but in no case did it exceed 63% kill of live stem. R. triste is particularly resistant to copper complex sprays. The shade form of R. bracteosum is more injured than the sun form. Further observations concerning the effect of chlorates on Oregon

3. Discussion of Results Obtained from 1930 Experiments.

Idaho: The mixture of magnesium chloride and sodium chlorate applied in several concentrations on Plot XI resulted in a fire of spontaneous origin 11 days after application. Therefore the kill shown in Table No. 1 for these experiments represents the effect of an extremely hot burn plus the action of the chemical. The toxic action of X and Y copper complex sprays on R. inerme was unsatisfactory. It is evident that the complex compound is not stable enough under the influence of reactive plant constituents to permit translocation of the chemical into root tissue. None of the sprays tested in 1930 showed sufficient kill of R. inerme to be recommended for large scale application. The results of sprays applied to plot numbers Xx 1-14 (see Table No. 1) were considered to be so poor as not to justify searching out crowns for a bush kill figure.

California: Reference to Table No. 2 shows that X and Y sprays were ineffective on R. nevadense, R. roezli and R. inerme (Meadow Valley). The addition of magnesium chloride to X at Meadow Valley noticeably increased the live stem kill. Figures for R. nevadense at Leland Meadow should be considered in the light of the age of the bushes and highly shaded conditions under which they are growing. The application of a magnesium chloride and sodium chlorate mixture to R. roezli and R. cereum at Gooseberry Camp was followed by a fire of spontaneous origin similar to the one at Santa, Idaho. The fire at Gooseberry Camp was very light and occurred the morning after application of the spray. Most of the chemical was washed off the bushes in extinguishing the fire. This accounts for the small injury to the California Ribes compared with the injury produced at Santa, Idaho. Data were retaken over the 1928 experimental plots in 1930 and compared with those taken in 1929. R. roezli's power of regeneration is shown by these data to be much greater than that of R. nevadense, a 20% bush kill for the former and 85% bush kill for the latter being representative of this difference. The effect of age on the general susceptibility of Ribes to chemical treatment is shown by the high kill obtained on R. nevadense at Leland Meadows.

Oregon: X and Y sprays were relatively ineffective on the following Oregon species: R. lacustre, R. bracteosum, R. triste, R. californicum and R. sanguineum. Injury appears to increase with concentration of the X or Y spray but in no case did it exceed 50% kill of live stem. R. triste is particularly resistant to copper complex sprays. The shade form of R. bracteosum is more injured than the sun form. Further observations concerning the effect of chlorates on Oregon

species are (1) small heavily shaded R. bracteosum are more susceptible than small sun forms, (2) large open forms of R. lacustre and R. bracteosum are more susceptible than small sun forms and are generally killed back to the crown, in contrast with a somewhat incomplete live stem kill in the smaller sun forms. Solutions of sodium chlorate or Atlacide stronger than 15% by weight are fairly satisfactory on R. lacustre and on shaded R. bracteosum but are not effective on open forms of R. bracteosum. The second application of alkaline and acid chlorate sprays to R. lacustre and R. bracteosum as shown in Table No. 4 did not result in complete eradication of either species.

C. Application of New Ribicides in Idaho, California and Oregon During 1930.

Idaho: New Ribicides were tested by (1) spray application, and (2) stem and crown injection to R. petiolare, R. inerme and R. lacustre at Santa, Idaho, by A. Bickford, G. R. Van Atta and the writer. Table No. 5 summarizes the spray experiments. Special crown and stem injections of various chemicals undertaken by Van Atta, Bickford and the writer are reported in Tables No. 6 and 7. These latter experiments were made almost entirely on R. inerme.

California: Sprays were applied by d'Urbal and Quick to R. roezli and R. nevadense on plots located near Leland Meadow and Strawberry, Stanislaus National Forest, California. Table No. 8 summarizes these experiments. The map which follows Table No. 8 gives the location of these spray experiments. Special crown injection experiments undertaken by Van Atta are reported in graphic form with a legend providing the experimental data.

Oregon: New Ribicides were tested on R. bracteosum and R. lacustre near Planters Cabin, Still Creek, and on R. watsonianum located near the Loop Highway on the South Fork of Iron Creek. At Huckleberry Mountain, Crater Lake National Forest, Atlacide sprays were applied to R. hallii. On Crater Lake National Park experimental plots were established in a suitable area of R. erythrocarpum. Results of these experiments are given in Table No. 9. The writer made several crown injections of copper complex to R. sanguineum close to the R. watsonianum plots on the Loop Highway. These applications were made to the scarified crowns of R. sanguineum on August 8. On August 27 a re-spray of $NaClO_3$ 30% was made on R. watsonianum Plot IV, Loop Highway.

species are (1) small heavily shaded R. bracteosum are more susceptible than small sun forms, (2) large open forms of R. lacustre and R. bracteosum are more susceptible than small sun forms and are generally killed back to the crown, in contrast with a somewhat incomplete kill stem kill in the smaller sun forms. Solutions of sodium chlorate as ribicide stronger than 15% by weight are fairly satisfactory on R. lacustre and on shaded R. bracteosum but are not effective on open forms of R. bracteosum. The second application of alkaline and acid chlorate sprays to R. lacustre and R. bracteosum as shown in Table No. 4 did not result in complete eradication of either species.

C. Application of New Ribicides in Idaho, California and Oregon During 1939.

Idaho: New ribicides were tested by (1) spray application, and (2) stem and crown injection to R. petiolare, R. inerme and R. lacustre at Santa, Idaho, by A. Pickford, C. R. Van Atta and the writer. Table No. 5 summarizes the spray experiments. Special crown and stem injections of various chemicals made later by Van Atta, Pickford and the writer are reported in Tables No. 6 and 7. These latter experiments were made almost entirely on R. inerme.

California: Sprays were applied by Offord and Moss to R. roezli and R. nevadense on sites located near Leland Meadow and Strawberry, Stanislaus National Forest, California. Table No. 8 summarizes these experiments. The map which follows Table No. 8 gives the location of these spray experiments. Special crown injection experiments undertaken by Van Atta are reported in graphic form with a legend providing the experimental data.

Oregon: New ribicides were tested on R. bracteosum and R. lacustre near Plantation Prospect, Mill Creek, and on R. erythrocarpum located near the Loop Highway on the south fork of Lost Creek, in Huckleberry Mountain, Crater Lake National Forest. Ribicide sprays were applied to R. inerme. At Crater Lake National Park experimental plots were established in a suitable area of R. erythrocarpum. Results of these experiments are given in Table No. 9. The writer made several crown injections of copper complex to R. erythrocarpum plants of the R. erythrocarpum plots on the Loop Highway. These applications were made to the specific crowns of R. erythrocarpum on August 8. On August 20 a re-spray of 20% was made on R. erythrocarpum Plot 17, Loop Highway.

TABLE NO. 5

SUMMARY OF EXPERIMENTAL SPRAYS APPLIED AT SANTA, IDAHO
DURING 1930 FIELD SEASON

Date of Application	Plot Number	Chemical Used	Concentration in Parts by Volume or Lbs. Per Gal. H_2O.	pH of Spray	Gallons Spray Used	At Time of Application: Average Soil Temp. 7:30 a.m. to 5 p.m. Degrees F.	Average Relative Humidity 7:30 a.m. to 5 p.m.	Weather Log
7/7/30	III A (2-3)	Pitch Oil (1)	As Furnished		6	61	38	Warm. Clear.
7/8/30	III A (6-6.6)	Pitch Oil + Pyridene	100 parts 1 part		2	63	44	Hot. Clear.
7/8/30	V A (1-2)	Pitch Oil + Furfural	20 parts 1 part		2	63	44	Hot. Clear.
7/10/30	V B (2-2.3)	Pitch Oil + Toluene	50 parts 1 part		1	68	74	Warm. Cloudy.
7/10/30	V B (2.3-3)	Pitch Oil + Benzene	50 parts 1 part		1	68	74	Warm. Cloudy.
7/10/30	V A (2-3)	Pitch Oil + Naphthalene	50 parts 1 part		1½	68	74	Warm. Cloudy.
7/16/30	I B (3-4)	X (2)	2.06#	10.0	5½	62	68	Warm. Clear.
7/16/30	I B (4-5)	X + Glue	2.6# 0.02#	10.0	4½	62	68	Warm. Clear.
7/17/30	IV B (1-2)	Pitch Oil + Cresylic Acid	50 parts 1 part		2	63	62	Warm. Clear.
7/17/30	IV A (3-4)	Pitch Oil + Phenol	50 parts 1 part		2	63	62	Warm. Clear.
7/24/30	III B (6-6.3)	Cadmium sulphate + Glycerine	.25# .02#	6.5	2	60	53	Warm. Clear.
7/24/30	III B (6.3-6.6) & II B (5-5.6)	Cadmium chloride + Glycerine	.25# .02#	6.5	2	60	53	Warm. Clear.
7/30/30	Opposite B (1-2)	Silver nitrate + Sodium thiosulphate	.45# 4.2#		¼	59	62	Hot. Clear.
7/30/30	Opposite VIII B (1-2)	Silver nitrate	.45#		¼	59	62	Hot. Clear.
8/1/30	Ex. 1	A + Buffer (3)	.45#	4.0	6	59	60	Warm. Clear.
8/2/30	Ex. 2	A	.45#	6.0	6	56	72	Warm. Clear.
8/2/30	Ex. 3	A + Buffer (3)	.45#	4.0	6	56	72	Warm. Clear.
8/4/30	Ex. 4	A + Buffer (4)	.45#	5.0	6	54	67	Hot. Clear.
8/5/30	Ex. 5	A + Buffer (3)	.83#	4.0	6	56	60	Hot. Clear.
8/5/30	Ex. 6	A	.83#	6.0	6	56	60	Hot. Clear.
8/5/30	Ex. 7	A + Buffer (4)	.83#	5.0	6	56	60	Hot. Clear.
8/11/30	Ex. 8	A + Buffer (5)	.45#	9.0	6	57	67	Hot. Clear.
8/12/30	Ex. 9	A + Buffer (5)	.83#	9.0	6	56	77	Hot. Clear.
8/13/30	Ex. 10	Atlacide and Buffer (3)	3.00#	4.0	6	57	88	Warm. Clear.
8/13/30	Ex. 11	Atlacide and Buffer (4)	3.00#	5.0	6	57	88	Warm. Clear.
8/14/30	X A (4.7-5)	Diesel Oil (6) + Pitch Oil	2 parts 1 part.		3	59	71	Warm. Cloudy.
8/14/30	X B (3.9-5)	Diesel Oil + Pitch Oil	3 parts 1 part		2	59	71	Warm. Cloudy.
8/14/30	X A (2.6-4.7)	Diesel Oil + Pitch Oil	4 parts 1 part		2½	59	71	Warm. Cloudy.
8/14/30	X B (3-3.9)	Diesel Oil	As furnished.		2	59	71	Warm. Cloudy.
8/18/30	III B (2-2.5)	Diesel Oil + Pyridene	100 parts 1 part		2	55	65	Warm. Clear.
8/18/30	III B (2.5-3.1)	Diesel Oil + Furfural	20 parts 1 part		2	55	65	Warm. Clear.
8/18/30	III B (3.1-4)	Diesel Oil + Cresylic Acid	50 parts 1 part		2	55	65	Warm. Clear.
8/18/30	III A (3-4)	Diesel Oil + Toluene	50 parts 1 part		2	55	65	Warm. Clear.
8/20/30	II A (2-2.5)	Diesel Oil + Benzene	50 parts 1 part		2	56	68	Warm. Clear.
8/20/30	II B (2.5-3)	Diesel Oil + Naphthalene	50 parts 1 part		2	56	68	Warm. Clear.
8/20/30	II B (1-1.4)	X + Glycerine	4.12# 0.45#	11.0	2	56	68	Warm. Clear.
8/20/30	II B (1.4-2)	X + Glycerine + Glue	4.12# 0.45# 0.04#	11.0	2	56	68	Warm. Clear.

(1) Pitch Oil, a product of coal tar distillation secured from Koppers Company, Pittsburgh, Pa.
(2) Standard copper complex from lot made in Spokane by H. R. Offord.
(3) Contains in each gal. water 62 gms. sodium acetate and 393.5 cc. HCl (350 cc. com. HCl diluted to 1000 cc.).
(4) Contains in each gal. water 62 gms. sodium acetate and 46 cc. HCl (350 cc. com. HCl diluted to 1000 cc.).
(5) Contains sodium acetate plus sodium hydroxide to pH 9.
(6) Standard Diesel Oil usually sold as fuel oil. Procured from Standard Oil Co., Spokane, Wash.

Note: Oil sprays applied to R. inerme and R. lacustre.
Buffered sodium chlorate sprays applied to R. petiolare.
Buffered Atlacide sprays applied to R. inerme.

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TABLE NO. 6

CROWN AND STEM TREATMENTS GIVEN TO
R. INERME AT SANTA, IDAHO, 1930.

Date of Experiment	Experiment Number	Method of Treatment (See Legend)	Chemical Used	No. Crowns or Stems Treated	Results as Noticed at End of Season
7/18/30	1	#1	X	3	Poor
7/18/30	2	#2	X	3	Fair
7/18/30	3	#3	X	3	Good
7/18/30	4	#4	X	3	Poor
7/18/30	5	#1	Pitch oil	3	Poor
7/18/30	6	#2	Pitch oil	3	Poor
7/18/30	7	#3	Pitch oil	3	Good
7/18/30	8	#4	Pitch oil	3	Poor
7/18/30	9	#5	Pitch oil	3	Fair
7/19/30	10	#1	Bismuth subbenzoate	3	Poor
7/19/30	11	#2	Bismuth subbenzoate	3	Poor
7/19/30	12	#3	Bismuth subbenzoate	3	Poor
7/19/30	13	#4	Bismuth subbenzoate	3	Poor
7/19/30	14	#1	Arsenic oxide	3	Good
7/19/30	15	#2	Arsenic oxide	3	Good
7/19/30	16	#3	Arsenic oxide	3	Good
7/19/30	17	#4	Arsenic oxide	3	Poor
7/28/30	18	#1	Cadmium sulphate	3	Good
7/28/30	19	#2	Cadmium sulphate	3	Good
7/28/30	20	#3	Cadmium sulphate	3	Good
7/28/30	21	#4	Cadmium sulphate	3	Poor
7/28/30	22	#1	Cadmium chloride	3	Good
7/28/30	23	#2	Cadmium chloride	3	Good
7/28/30	24	#3	Cadmium chloride	3	Good
7/28/30	25	#4	Cadmium chloride	3	Poor
7/30/30	26	#6	Soluble copper cyenide	3	Fair
7/30/30	101	#6	Soluble copper cyenide	2	Fair
7/31/30	27	#1	Fluorescein	2	Poor
7/31/30	28	#2	Fluorescein	2	Poor
7/31/30	29	#3	Fluorescein	2	Poor
7/31/30	30	#4	Fluorescein	2	Poor
7/31/30	31	#1	Silver nitrate	2	Poor
7/31/30	32	#2	Silver nitrate	2	Poor
7/31/30	33	#3	Silver nitrate	2	Poor
8/1/30	IV A (1-1.3)	#6	X - 25%	25	Fair
8/14/30	IV A (1.3-1.6)	#6	A - 25%	12	Fair
8/19/30	II A (2-3)	#7	X + Eosine	20 - 30	Good
8/21/30	34	#7	X + Eosine	4	Good

Method #1 - Portion of bark over crown scraped off with knife and chemical applied to wound as aqueous paste.

Method #2 - Crown notched into xylem and chemical applied to wound as aqueous paste.

Method #3 - Crown scratched with pruning saw and chemical applied as aqueous paste.

Method #4 - Stems cut off several inches above ground and thin aqueous paste applied to ends of cut off stems.

Method #5 - Chemical applied in aqueous solution (or oil) about crown. No scarification of crown or stems.

Method #6 - One or more holes drilled into crown below stem tissue with Yankee twist drill. Chemical injected into these holes in aqueous solution by means of a modified Zerk grease gun.

Method #7 - One or more stems slit with knife near crown and chemical in form of thick aqueous paste packed into the slit stem.

TABLE NO. 7

ABSORPTION AND MOVEMENT OF INJECTED SUBSTANCES AS SHOWN BY EOSIN SOLUTION

Expt. No.	Date of Treatment	Species	Duration of Treatment	Distance Stain Moved Up	Distance Stain Moved Down	Quantity of Solution Absorbed
1	Aug. 14	R. inerme	30 min.	11-1/2"	3"	1.5 cc.
2	" "	R. petiolare	30 "	33"	5"	0.3 cc.
3	" "	R. lacustre	20 "	17"	4-1/4"	Not measured
4	" 15	R. inerme	45 "	28"	3-1/2"	" "
5	" "	R. inerme	45 "	31"	7-1/2"	" "
6	" "	R. inerme	45 "	7"	1-1/2"	" "
7	" "	R. petiolare	30 "	47-1/2"	7"	0.5 cc.
8	" "	R. petiolare	30 "	15"	5"	0.1 cc.
9	" "	R. petiolare	30 "	24"	3-1/2"	Not measured
10*	Aug. 19-20	R. inerme	48 hrs.	96"	24"	5.9 cc.
11**	" 21-23	R. petiolare	48 "	79"	12"	Not measured
12***	" 23-25	R. petiolare	48 "	30"	7"	" "
13	" 25	R. inerme layering stem	30 min.	7-1/2"	3-1/2"	" "

* Leaves and small twigs deeply colored. Radial spread not appreciable. Rays unstained. Circumferential spread through annual rings. Longitudinal spread at distance from point of injection entirely through new xylem. Old xylem only stained in vicinity of point of injection.

**Reservoir had leaked during experiment. Leaves deeply stained. Wood rays more deeply stained than in case of R. inerme similarly treated.

***Scant circumferential spread.

August ratio of movement up to movement down:

R. inerme 3.81 : 1
R. petiolare 5.30 : 1
R. lacustre 4.0 : 1

Figures given in experiment 13 are not included in the above, since these results are not comparable.

TABLE NO. 8

SUMMARY OF EXPERIMENTAL SPRAYS APPLIED IN CALIFORNIA
DURING 1930 FIELD SEASON

Date of Appli-cation	Plot Number	Chemical Used	Concen-tration Lbs. Per Gal. or % by Vol.	pH of Spray	Gal-lons Spray Used	At Time of Application *	
						(5) Atmometer Reading	Average Relative Humidity 7:30 a.m. to 5 p.m.
	Leland Meadows Sec. 10, R. 18 E, T. 4N.,						
7/1/30	1	Atlacide	1.4	5.0		5.1	47
7/1/30	2	Atlacide	1.4	3.6	5	5.1	47
7/1/30	3	Atlacide	1.4	4.0	5	5.1	47
7/1/30	4	Atlacide	1.4	4.5	5	5.1	47
7/2/30	5	Atlacide	2.4	5.0	5	5.8	46
7/2/30	6	Pitch Oil + Toluol	5%		5	5.8	46
7/2/30	7	Atlacide	3.6	3.6	5	5.8	46
7/1/30	8	Atlacide	2.4	4.5	5	5.1	47
7/1/30	9	A	1.4	3.5	5	5.1	47
7/1/30	10	A	0.89	5.0	5	5.1	47
7/1/30	11	A	0.89	4.5	5	5.1	47
7/1/30	12	A	0.89	4.0	5	5.1	47
6/24/30	13	A	0.89	3.6	5	5.5	37
7/4/30	14	Atlacide	2.4	4.0	5	4.4	40
6/24/30	15	Atlacide	2.4	4.0	5	5.5	37
6/24/30	16	Pitch Oil + Phenol	2%		5	5.5	37
6/24/30	17	A	0.44	4.5	5	5.5	37
6/24/30	18	A	0.44	5.0	5	5.5	37
6/24/30	19	Atlacide	2.4	4.0	5	5.5	37
6/25/30	20	A	0.44	4.0	5	4.9	44
6/25/30	21	A	0.44	5.0		4.9	44
6/25/30	22	Pitch Oil + Pyridene	5%		5	4.9	44
6/25/30	23	Pitch Oil + Cresol	2%		5	4.9	44
6/25/30	24	Pitch Oil + Furfural	5%		5	4.9	44
6/25/30	25	Pitch Oil + Benzol	2%		5	4.9	44
6/30/30	26	A	0.89	**	5	5.0	45
6/30/30	27	A	1.4	**	5	5.0	45
6/30/30	28	A	0.44	**	5	5.0	45
6/30/30	29	Atlacide	0.67	**	5	5.0	45
6/30/30	30	Atlacide	1.4	**	5	5.0	45
6/30/30	31	Atlacide	2.4	**	5	5.0	45
6/30/30	32	Pitch Oil + Naphthalene	5%		5	5.0	45
	Strawberry, T. 4 N., R. 18 E., Sec. 2.						
6/23/30	1	Pearl Oil Sulphur Dioxide Extract			5	5.5	39
6/23/30	2	Mineral Oil Sulphur Dioxide Extract			5	5.5	39
6/23/30	3	De Ong Oil (3)	15%		2	5.5	39
6/23/30	4	De Ong Oil	10%		2	5.5	39
6/24/30	5	Diesel Oil			5	5.5	37
6/24/30	6	Pitch Oil + Diesel Oil	50% + 50%		5	5.5	37
6/24/30	7	Pitch Oil + Diesel Oil	25% + 75%		5	5.5	37
6/24/30	8	Pitch Oil + Diesel Oil	12% + 88%		5	5.5	37
6/24/30	9	Diesel Oil + Phenol + Cresol	98% 1% 1%		5	5.5	37
6/23/30	10	Diesel Oil + Pyridene	95% + 5%		5	5.5	39
6/23/30	11	Diesel Oil + Naphthalene + Toluol + Cresol + Phenol	88% 5% 5% 1% 1%		5	5.5	39
6/23/30	12	Diesel Oil + Furfural	95% + 5%		5		
6/24/30	13	X (4)	2.7	11.0	5	5.5	37
7/4/30	14	A	1.4	5.0	5	4.4	40
6/24/30	15	X	2.7	6.5	5	5.5	37
6/24/30	16	X	3.5	11.0	5	5.5	37
6/24/30	17	X	3.6	6.5	5	5.5	37
7/24/30	18	A	1.4	4.0	5	4.4	40
7/24/30	19	A	1.4	4.5	5	4.4	40

(1) Pitch Oil, a by-product of coal tar distillation secured from Koppers Company, Pittsburgh, Pa.
(2) Symbol for sodium chlorate.
(3) Sample of California oil equivalent to pitch oil. Furnished by Mr. E. R. De Ong of San Francisco.
(4) Symbol for standard copper complex made in Spokane by H. R. Offord.
(5) Atmometer, an instrument used for determining the rate of evaporation. Used this year for the first time in our work.

* The weather was clear and sunny during the entire period of experimentation.
** No buffer.

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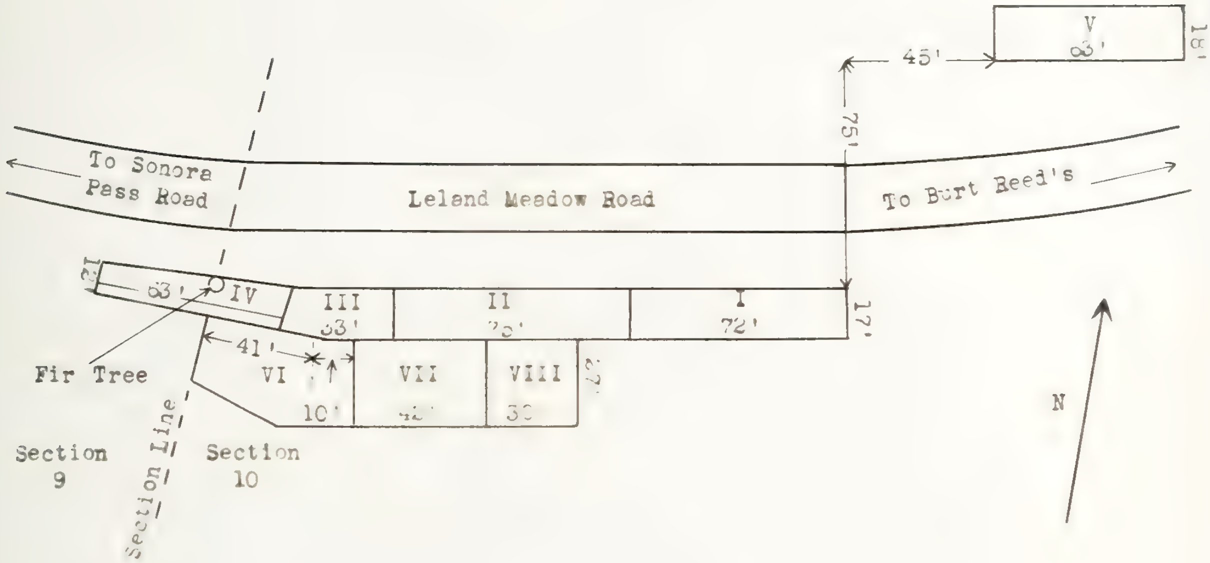
PRESSURE CROWN INJECTION EXPERIMENTS ON R. ROEZLI
STANISLAUS NATIONAL FOREST, CALIFORNIA
1930



Date of Treatment	Plot No.	Chemical Used	No. Bushes Treated
July 1[illegible], 1930	I	25% Soln. $NaClO_3$ + eosine	6
July 16, 1930	II	25% Soln. $Na_3Cu(CN)_4$ + eosine	10
July 16, 1930	III	25% Soln. $CCl_3CH_3O_2$ + eosine	4
July 16, 1930	IV	25% Soln. X	5
July 16, 1930	V	25% Soln. Cr complex	5
July 21, 1930	VI*	25% Soln. $NaClO_3$	6
July 21, 1930	VII*	Diesel Oil	5
July 21, 1930	VIII	Diesel Oil	6

*Tops of bushes removed and crown exposed prior to injection.

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TABLE NO. 9

SUMMARY OF EXPERIMENTAL SPRAYS APPLIED IN OREGON DURING 1930 FIELD SEASON

Date of Application	Plot Number	Chemical Used	Concentration Lbs. Per Gal. H_2O.	pH of Spray	Gallons Spray Used	At Time of Application	
						Relative Humidity	Weather Log
8/5/30	Still Creek I	A	0.89	4.0	5	p.m. 46	Warm. Breezy.
8/6/30	II (0-1)	A + Calcium chloride	2.70 2.70	7.0	5	a.m. 59	Warm. Clear.
8/28/30	II (2-3)	A + Sodium chloride	1.40 1.40	3.5	5	a.m. 21	Clear. Very dry.
8/5/30	II (0-1)	Atlacide	3.60	3.5	5	p.m. 46	Warm. Breezy.
8/5/30	III (1-3)	A	0.89	4.0	5	p.m. 46	Warm. Breezy.
8/5/30	IV	Atlacide	3.60	9.0	5	p.m. 46	Warm. Breezy.
8/28/30	V	A + Sodium chloride	0.89 2.08	3.5	5	a.m. 21	Clear. Very dry.
8/28/30	VI	A + Sodium chloride	0.44 2.70	3.5	5	a.m. 21	Clear. Very dry.
8/4/30	I A (3-3.5)	A	2.08	4.0	5	a.m. 79	Clear.
8/4/30	I A (3.5-4)	A	1.40	4.0	5	a.m. 79	Clear.
8/4/30	I B (3-3.5)	A	2.08	3.5	5	a.m. 79	Clear.
8/4/30	I B (3.5-4)	A	1.40	3.5	5	a.m. 79	Clear.
8/6/30	VII A (0-1)	A	0.89	4.0	5	a.m. 59	Clear. Warm.
8/5/30	VII A (1-2)	Atlacide	3.60	3.5	5	p.m. 46	Warm. Breezy.
8/5/30	VII A (2-3)	Atlacide	3.60	9.0	5	p.m. 46	Warm. Breezy.
8/5/30	VIII	A	2.08	7.0	5	p.m. 46	Clear.
8/7/30	IX	A	0.89	7.0	5	a.m. 80	Overcast.
8/7/30	X	Diesel Oil	100%		5	a.m. 80	Overcast.
8/6/30	XI (0-1)	A	1.40	7.0	5	a.m. 59	Clear. Warm.
8/6/30	XI (1-2)	A + Calcium chloride	2.70 2.70	9.0	5	a.m. 59	Clear. Warm.
8/4/30	XII (0-1)	A	2.08	4.0	5	a.m. 79	Clear.
8/6/30	XII (1-2)	A	0.89	4.0	5	a.m. 59	Clear. Warm.
8/7/30	XIII	Diesel Oil + Furfural	95% 5%		5	a.m. 80	Overcast.
8/9/30	Loop Highway I	A	2.08	3.5	5	p.m. 50	Warm.
8/9/30	II	A	2.08	7.0	5	p.m. 50	Warm.
8/27/30	IV	A (Re-spray 1929 plot)	2.08	7.0	2	p.m. 50	Warm.
8/23/30	Huckleberry Mt. VII	Atlacide	3.60	7.0			
8/23/30	VII	Atlacide	3.60	4.0			
8/16/30	Crater Lake N.P. IA(0-1)	Atlacide	1.40	6.5		Low	Cool with occasional clouds.
8/16/30	IA(1-2)	Atlacide	1.40	4.5		Low	
8/16/30	IA(2-3)	Atlacide	3.60	6.5		Low	
8/16/30	IB(0-1)	Atlacide	0.67	6.5		Low	
8/18/30	IB(1-2)	Atlacide	0.67	4.5		Higher than 16th	Overcast Sun at intervals
8/18/30	IB(2-3)	Atlacide	3.60	4.5			

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D. Late Season Notes on 1930 Experiments in Idaho, California and Oregon.

No conclusions could be drawn regarding the increased toxicity of buffered sodium chlorate and Atlacide solutions. Pitch oil proved to be so irritating to exposed skin that its use as a ribicide is not contemplated. In general Diesel oil proved to be quite as toxic as the pitch oil. No releafing was observed on R. roezli which had been sprayed with Diesel oil. Dilute cadmium sulphate and cadmium chloride sprayed on R. inerme showed complete kill of live stem at the end of the growing season.

Copper complex, cadmium sulphate, cadmium chloride and sodium chlorate are excellent killing agents when injected into or applied to incisions on stems or roots. A method of packing a copper complex paste into the basal portions of R. inerme stems subsequent to slitting these stems appeared to merit further investigation. R. inerme so treated showed excellent top kill though a possibility of re-sprouting exists. These experiments will be watched with interest next year. R. roezli injected with copper complex by means of a Zerk pressure gun showed some re-sprouts at the end of the field season. Some crown and stem injections made September 14 and 15 by Patty and Pierson near Cow Creek were made too late in the season to be significant. Iodine and copper complex were tested in these experiments by the stem injection method.

RECOMMENDATIONS FOR LARGE-SCALE APPLICATION OF CHEMICALS, 1931

Recommendations for the chemical eradication of R. petiolare are now made as follows:-

1. For early season up to July 15:

   $NaClO_3$ 0.5# per gallon of water at pH of 6.1 - 6.8.

2. For mid-season work, July 15 to August 15:

   Atlacide 1.04# per gallon of water at pH of 6.1 - 6.8.

3. For work done after August 15:

   $NaClO_3$ 0.89# per gallon of water at pH of 6.1 - 6.8.

These recommendations are based on an analysis of field data from Santa and Clarkia, Idaho, and on a laboratory study of the total

starch reserves which correlate in general the seasonal results obtained from field experiments.

For the eradication of *R. inerme* a dilute aqueous (0.5 to 1# per gallon water) solution of sodium chlorate applied to the soil about the crown of each plant has proved to be 100% effective. This method should be given a thorough test both as an initial method and as a follow-up method to the above sprays recommended for *R. petiolare*. Diesel oil applied as a spray and copper complex applied as a stem injection have shown real possibilities in preliminary tests. These chemicals might be used as indicated either as a preliminary or follow-up treatment in combination with hand eradication.

For the eradication of *R. bracteosum* $NaClO_3$ 1.4# per gallon of water at a pH of 6.8 with the clean-up by hand pulling is recommended. A high kill of live stem is obtained with the sodium chlorate which satisfactorily prepares the ground for eradication of surviving root centers the ensuing year.

Crown applications of chlorates to *R. roezli* and *R. nevadense* are successful from the point of view of killing but the fire hazard and shortage of water involve too many difficulties for California work. Injection of copper complex into stems and crowns of *R. roezli* appears to be most practicable for field work.

A careful analysis of field data and results of laboratory investigations shows the following to be true:-

(1) that no assurance can be given that in the near future a spray will be found which will give 100% kill of resistant Ribes with one application;

(2) that the resistant Ribes can be successfully killed by chemical methods other than spraying.

In the light of these facts every effort should be made next year to make a comprehensive field study of (1) chemical methods, and (2) combination of chemical and hand pulling methods.

PART II

INVESTIGATIONS IN CHEMICAL METHODS FOR THE ERADICATION OF BARBERRY

Experimental work upon the chemical eradication of barberries was performed under the terms of a cooperative agreement with the Office of Barberry Eradication, Bureau of Plant Industry which resulted in the allotment of $6,500 to this work from the appropriation for barberry eradication. The following Memorandum of Understanding between the Office of Blister Rust Control and the Office of Barberry Eradication gives the basis of this cooperative work:

MEMORANDUM OF UNDERSTANDING
Between
THE OFFICE OF BLISTER RUST CONTROL
and
THE OFFICE OF BARBERRY ERADICATION
BUREAU OF PLANT INDUSTRY
UNITED STATES DEPARTMENT OF AGRICULTURE.

Relative to

Cooperative Investigations on Chemical,
Methods of Eradicating Barberries.

Effective: April 15, 1930.

The object of this cooperative work is to determine chemicals which are toxic to barberry species and varieties known to be alternate hosts of the stem rust fungus, and to develop practical and economical methods of chemical eradication in the 13 north central grain growing states, Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming. Laboratory headquarters for this work will be maintained at the University of California, Berkeley, California.

A. The Office of Blister Rust Control agrees:

1. To assign to these investigations a member of the staff of the Office of Blister Rust Control who shall be in direct charge of the work. All phases of the investigations shall be carried out with the full knowledge of the Office of Barberry Eradication.
2. To plan and carry out a general survey of the field of Barberry Eradication methods and to develop a program of research on chemical eradication.

PART II

INVESTIGATIONS ON CHEMICAL METHODS FOR THE ERADICATION OF BARBERRY

Experimental work upon the chemical eradication of barberries was performed under the terms of a cooperative agreement with the Office of Barberry Eradication, Bureau of Plant Industry which resulted in the allotment of $5,500 to this work from the appropriation for barberry eradication. The following Memorandum of Understanding between the Office of Blister Rust Control and the Office of Barberry Eradication gives the basis of this cooperative work:

MEMORANDUM OF UNDERSTANDING
Between
THE OFFICE OF BLISTER RUST CONTROL
and
THE OFFICE OF BARBERRY ERADICATION
BUREAU OF PLANT INDUSTRY
UNITED STATES DEPARTMENT OF AGRICULTURE

Relative to

Cooperative Investigations on Chemical Methods of Eradicating Barberries.

Effective: April 15, 1935.

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2. To plan and carry out a general survey of the field of barberry eradication methods and to develop a program of research on chemical eradication.

3. To cooperate with all agencies concerned in the development of plans, if results of the above research warrant them, for chemical engineering studies of practical methods of applying chemical killing agents to barberries in the so-called barberry eradication area.

B. The Office of Barberry Eradication agrees:

1. To provide all information available on the taxonomy and ecology and culture of rust susceptible species, varieties and hybrids and to assist in making a general survey of the barberry eradication situation.

2. To pay the salaries and traveling expenses of employees engaged on barberry eradication studies.

3. To furnish the necessary chemicals, equipment and other supplies in connection with field, laboratory or greenhouse studies.

C. It is mutually agreed:

1. That general plans for the investigations shall be developed jointly by the proper officials of both cooperating agencies. Responsibility for the supervision and execution of the technical details of the work shall rest with the Office of Blister Rust Control.

2. That records of the results of field tests shall be secured jointly by representatives of the two offices involved. Duplicate copies of such experimental notes and records as may be mutually agreed shall be made, a copy to be supplied each cooperating agency. Such regular reports as may be mutually agreed upon shall be furnished the Office of Barberry Eradication.

3. That publications of results will be made as contributions from the Office of Barberry Eradication and may be joint or independent as may at the time be agreed upon by the cooperating agencies.

4. That the obligations of the Office of Barberry Eradication and the Office of Blister Rust Control are contingent upon appropriations being made by Congress from which expenditures may legally be met.

5. That all Government funds expended in connection with these investigations shall be disbursed in accordance with the fiscal regulations of the United States Department of Agriculture.

3. To cooperate with all agencies concerned in the development of plans, if results of the above research warrant them, for chemical engineering studies of practical methods of applying chemical killing agents to barberries in the so-called barberry eradication area.

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1. To provide all information available on the taxonomy and ecology and culture of rust susceptible species, varieties and hybrids and to assist in making a general survey of the barberry eradication situation.

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3. That publications of results will be made as contributions from the Office of Barberry Eradication and may be joint or independent as may at the time be agreed upon by the cooperating agencies.

4. That the obligations of the Office of Barberry Eradication and the Office of Blister Rust Control are contingent upon appropriations being made by Congress from which expenditures may legally be met.

5. That all Government funds expended in connection with these investigations shall be disbursed in accordance with the fiscal regulations of the United States Department of Agriculture.

6. That the Office of Barberry Eradication will expend on these investigations approximately $1,000 during the Fiscal Year 1930 and approximately $6,500 during the Fiscal Year 1931. The Office of Blister Rust Control will contribute the facilities as specified under section A. The contributions will continue approximately as indicated for the Fiscal Year 1931. Changes in amount may be made by mutual agreement in advance of a Fiscal Year.

7. That no part of the money allotted to this work by the Office of Barberry Eradication shall be used to pay the cost or value of property injured or destroyed.

8. That this memorandum of understanding shall take effect April 15, 1930 to continue for an indefinite period and shall be subject to revision or termination by mutual consent of the parties concerned. Not less than ninety days notice of termination or any major change desired shall be given the other party to this agreement.

Date: 5/8/30 (s) S. B. Detwiler
Principal Pathologist in Charge, Office of Blister Rust Control.

Date: 4/18/30 (s) F. C. Meier
Principal Pathologist in Charge, Office of Barberry Eradication.

Date: 5/26/30 (s) Wm. A. Taylor
Chief, Bureau of Plant Industry

INTRODUCTION

In the spring of 1930 the Bureau of Plant Industry approved a plan whereby the Office of Blister Rust Control would cooperate with the Office of Barberry Eradication for the following purpose: to determine chemicals which are toxic to barberry species and varieties known to be alternate hosts of the black stem rust fungus, and to develop practical and economical methods of chemical eradication in the thirteen north central grain growing states. It is the belief of both cooperating agencies that the proposed work will be valuable on the one hand as a further test of experimental data obtained in the course of Ribes investigated and on the other as a means of utilizing a going research organization with a "modus operandi" already well established. Comprehensive field and laboratory experiments were planned.

As the preliminary step in this work Mr. D. Fletcher, Field Supervisor of the Barberry Office, conducted S. N. Wyckoff and the writer over typical (eradicated and non-eradicated) barberry areas in Wisconsin and Illinois. R. A. Caldwell and R. W. Bills, barberry leaders for Wisconsin and Illinois, mapped out the itinerary in their respective states. Following this, typical barberry sites in Ohio were visited with Dr. F. C. Meier, Chief of the Office of Barberry Eradication, and Mr. H. Atwood, state leader for Ohio. The prime object of this travel was to locate an area of barberries suitable for (1) a comprehensive test of chemicals on a permanent plot basis, and (2) collections of material for subsequent morphological and chemical laboratory investigations. While looking for a suitable area S. N. Wyckoff and the writer were enabled to familiarize themselves with (1) the various ecological forms of barberry, (2) methods now employed for eradication of barberry, and (3) regeneration of barberry (seedling and root sprouts) following initial eradication.

An area at Maumee, Ohio, some thirty acres in extent, finally was selected for the 1930 field experiments. This area was part of a 90-acre tract of land located 2½ miles southeast of Maumee on the Salisbury Road. The land was owned by the France Stone Company of Toledo, Ohio, and was under lease to L. H. Abel for pasture lands. Arrangements were made whereby two portions of the 90-acre tract were fenced off and retained for experimental purposes. In making arrangements for the use of the land and in subsequent experimental work, Mr. H. Atwood rendered valuable and timely assistance.

SUMMARY OF EXPERIMENTS CONDUCTED AT MAUMEE, OHIO DURING 1930 SEASON

In planning the field experiments on barberry, advantage was taken of the several years' experience with Ribes by selecting certain key chemicals which had proved representative of distinct types of killing action. These chemicals were to be tested: (1) as a spray, (2) as a crown application in liquid form, and (3) as a crown application in solid form. Sprays were to be tested at various pH values, and in so far as compatible with the late start, the seasonal effect was to be noted for these key chemicals. After a thorough discussion of the whole problem with Dr. Meier who pointed out the desirability for a practicable chemical method for the eradication of barberry from private properties, a series of injection experiments were planned. The prime purpose of these experiments was to develop a method whereby a small amount of chemical might be specifically applied to barberry in such a way that adjacent plants would not suffer, the soil remain fertile, and the landscape be disfigured to a minimum extent.

On June 16, C. E. Draper and R. E. Hungate reported at Toledo, Ohio for field work on the experimental area at Maumee, Ohio. The writer stayed at Maumee until June 24 assisting in the organization of the work. By July 10 two experimental areas (hereafter recorded as Area 1 and Area 2) had been fenced, the fenced areas marked off into permanent plots two rods square and the barberries on each individual plot counted and marked. Stake heads were painted white, plot symbols were lettered in black on the south face of each stake, and experimental data for each plot were lettered on the key stake at the southwest corner of each plot.

Spraying experiments were aimed primarily against seedlings and small bushes, though a fair sample of larger bushes was included in all tests. Crown applications were made with large bushes in mind: injection experiments were also chiefly concerned with the larger bushes. Barberries tested by spray application were marked by means of a short length of white cheesecloth tied about a stem. Bushes used for crown application experiments were numbered consecutively from 1 to 169 and marked and labeled with half a strip of Indestructo metal tied to a stem. Each bush so treated was further marked by a wire stake to which a piece of white cheesecloth was tied. Injection experiments were marked similarly to crown application and were numbered from 170 to [illegible]. In most cases two or more bushes were tested by each of the experiments listed under crown application and stem injection. Six plots were selected in Area 2 as check plots. These plots were located in different parts of the area so chosen as to be representative of the various conditions of soil and temperature which were encountered in the course of the chemical tests.

Sprays were applied with the five-gallon knapsack sprayer developed by the Office of Blister Rust Control for general field work.

This sprayer produces a fine mist spray which, in Ribes work, has provided a rapid and economical coverage of stems and leaves. It might be noted that even with the use of glue and glycerine as spreaders, the leaves of common barberry are very difficult to wet. This is particularly true of the younger leaves. Spray experiments are tabulated in Table No. 1.

Crown applications were made by applying to the soil about the base of the plant a known quantity of chemical either as a solid or in aqueous solution. Aside from removing surface litter no preparatory treatment was given to the soil or the bush. Crown application experiments are also reported in Table No. 1.

Injection experiments were made according to the legend in Table No. 4 and are summarized in the same table.

Collection data in Table No. 2, pH determinations in Table No. 3, and a list of plants on the Maumee area comprise the remainder of the data secured from the 1930 experiments. Relative humidity, air temperature and general weather notes were taken on days when sprays were applied. These data will be included in the final report on the effectiveness of sprays. In the course of these experiments, 6,046 barberries were marked as treated plants and 777 barberries marked as check plants.

Maps of Areas 1 and 2 are included in the report to show the location of plots and the scheme used to number these plots. All experimental data appearing on these maps refer to spray experiments.

TABLE NO. 1

CHEMICALS TESTED AS SPRAYS AND CROWN APPLICATIONS TO COMMON BARBERRY. MAUMEE PLOTS. 1930

Date of Experiment	Chemical Used	Method of Application	Applied to Plots
July 19, 1930	Copper Complex	Spray	Area 1, (0-3)A,0B,4A,4B
July 21, 1930	Copper Complex	Spray	Area 1, (1-3)B,2C
July 21, 1930	Zinc Ammonium Chloride	Spray	Area 1, 3C,3D
July 21, 1930	Sodium Tetraborate	Spray	Area 1, 2E
July 21, 1930	Ammonium Chloride	Spray	Area 1, 0E
July 21, 1930	Sulphuric Acid	Spray	Area 1, 0F
July 22, 1930	Sodium Chlorate	Spray	Area 1, 1C,1D,0D,1E
July 23, 1930	Sodium Chlorate	Spray	Area 1, 0C,2F,1F,2D
July 24, 1930	Sodium Chlorate	Spray	Area 2, 20G,20H
July 24, 1930	Atlacide	Spray	Area 2, 19H,19H2
July 25, 1930	Atlacide	Spray	Area 2, 17H,17E,17F,18E,18F,16G
July 25, 1930	Pitch Oil + Pyridene	Spray	Area 2, 17G,14H,15I
July 28, 1930	Sodium Hydroxide	Spray	Area 2, 16J
July 28, 1930	Pitch Oil + Furfural	Spray	Area 2, 18I
July 28, 1930	Pitch Oil + Cresylic Acid	Spray	Area 2, 14F,15F
July 28, 1930	Pitch Oil + Phenol	Spray	Area 2, 13G,14G
July 29, 1930	Sodium Chlorate	Crown Application Solution	Area 2, (8-14)A
July 29, 1930	Sodium Chlorate	Crown Application Solid	Area 2, 7A
July 29, 1930	Atlacide	Crown Application Solid	Area 2, 6A
July 30, 1930	Atlacide	Crown Application Solution	Area 2, 5A,6A,0B,1B,2B
July 30, 1930	Pitch Oil	Crown Application	Area 2, 2B,3B
July 30, 1930	Pitch Oil + Pyridene	Crown Application	Area 2, 4B,5B
July 30, 1930	Pitch Oil + Cresylic Acid	Crown Application	Area 2, (6-7)B
July 31, 1930	Pitch Oil + Phenol	Crown Application	Area 2, (9-12)B
July 31, 1930	Zinc Ammonium Chloride	Crown Application Solution	Area 2, 14B,7C,8C,10C,13C
July 31, 1930	Copper Complex	Crown Application Solution	Area 2, (1-3)C,5C,6C
July 31, 1930	Copper Complex	Crown Application Solid	Area 2, 0C,1D
July 31, 1930	Zinc Ammonium Chloride	Crown Application Solid	Area 2, 2D,4D,5D
August 1, 1930	Sodium Fluoride + Calcium Chloride	Crown Application Solution	Area 2, 9D,(11-13)D
August 1, 1930	Sodium Fluoride + Sodium Hydroxide	Crown Application Solution	Area 2, 15D
August 1, 1930	Atlacide	Crown Application Solid	Area 2, 2E
August 1, 1930	Sodium Fluoride + Sodium Hydroxide	Crown Application Solid	Area 2, (5-7)E
August 4, 1930	Ammonium Chloride	Crown Application Solid	Area 2, 12E,13E,13F,12F,(7-9)F
August 15,1930	Kerosene	Spray	Area 2, 14D
August 15,1930	Kerosene + Phenol	Spray	Area 2, 14D
August 15,1930	Pitch Oil	Spray	Area 2, 15D
August 16,1930	Pitch Oil + Pyridene	Spray	Area 2, 2M,3M
August 16,1930	Pitch Oil + Furfural	Spray	Area 2, 6L
August 18,1930	Pitch Oil + Cresylic Acid	Spray	Area 2, 8H,8G
August 18,1930	Sodium Chlorate	Spray	Area 2, 2N
August 19,1930	Sodium Chlorate	Spray	Area 2, (0-7)M,(0-4)L,(0-4)K,(0-3)J, (4-7)N,5C
August 20,1930	Sodium Chlorate	Spray	Area 2, 18E,19G
August 21,1930	Sodium Chlorate	Spray	Area 2, 18G
August 22,1930	Atlacide	Spray	Area 2, 16F,16F2
August 23,1930	Atlacide	Spray	Area 2, 17I,5K,5L,16H
August 24,1930	Copper Complex	Spray	Area 2, 16I,13E,14E,15C,15G
August 25,1930	Copper Complex	Spray	Area 2, 13(A-D), 14(A-C),15B,12(A-G), 13F,11A,15J,13H,12H,11G,11H, 10G,9G
August 25,1930	Sulphuric Acid	Spray	Area 2, 9H,10H
August 25,1930	Sodium Hydroxide	Spray	Area 2, 7H
August 26,1930	Zinc Ammonium Chloride	Spray	Area 2, (4-6)J,5I,6I,5H,6H,(0-3)H, (0-3)I,(0-7)G,(0-5)F
August 27,1930	Sodium Tetraborate	Spray	Area 2, (6-11)F,(B-E)11,10A,10B
August 27,1930	Pitch Oil + Phenol	Spray	Area 2, 10C,10D,(A-E)9,8A,8B
August 27,1930	Sodium Chlorate	Spray	Area 2, (A-E)6,(A-E)5,4E,4D,(A-C)4, (A-E)3,(A-E)2,(A-E)1,(C-D)0
August 27,1930	Atlacide	Dusted On	Area 2, 0E

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TABLE NO. 2

BERBERIS VULGARIS. COLLECTIONS SUMMARY.

Serial Number	Date Collected	Portions of Plant Collected	To Be Used for
pH (1-4)	7/16/30	Leaves, current stems, old stems and roots	pH determination
P (1-3)	7/15/30	Leaves, old stems, roots	Proximate analysis
T (1-4)	7/16/30	Leaves, current stems, old stems and roots	Tannin analysis
H (1-3)	7/18/30	Leaves, stems, roots and seedlings	Morphological work
pH (5-8)	8/4/30	Leaves, current stems, old stems and roots	pH determination
pH (9-12)	8/26/30	Leaves, current stems, old stems and roots	pH determination
T (5-8)	8/29, 8/30, 9/2, 9/3/30	Leaves, current stems, old stems and roots	Tannin analysis
-	9/7/30	Barberry seedlings (2,000) and supply of fruits	Greenhouse propagation

TABLE NO. 3

H-ION DETERMINATIONS ON BARBERRY PLANTS 1930*

Material	Date Specimens Taken		
	July 17	August 5	August 30
Leaves			
sap expressed**	20.8	24.0	21.2
pH	3.02	3.03	2.98
Young stems			
sap expressed	13.2	3.6	0.0
pH	4.94	4.66	-
Old stems			
sap expressed	7.8	0.0	4.6
pH	5.09	-	4.62
Roots			
sap expressed	7.6	0.0	13.8
pH	5.26	-	5.13

Method: All tissues ground and sap expressed under a pressure of 2,500 pounds per sq. in. pH determination with quinhydrone electrode.

*Work done by Dr. B. S. Meyer of Ohio State University.

**CC. per 100 gms. tissue.

A LIST OF PLANTS ON MAUMEE EXPERIMENTAL AREA
OHIO

TREES

Juniper virginiana L.	Red Cedar
Salix sp.	Willow
Populus tremuloides Michx.	Aspen
Populus deltoides Marsh	Cottonwood
Malus sp.	Crab Apple
Crataegus sp.	Hawthorn, two species at least
Juglans nigra L.	Black Walnut
Carya sp.	Hickory, at least two species
Carpinus caroliniana Walt.	Blue Beech
Quercus alba L.	White Oak
Quercus bicolor Willd.	Swamp White Oak
Quercus muhlenbergii Engelm.	Chinquapin Oak
Quercus palustris Muench.	Pin Oak
Quercus velutina Lam.	Yellow Oak
Quercus imbricaria Michx.	Shingle Oak
Ulmus americana L.	White Elm
Celtis occidentalis L.	Hackberry
Sassafras verifolium (Salisb.) Ktze.	Sassafras
Plantanus occidentalis L.	Sycamore
Amelanchier canadensis (L.) Medic.	Serviceberry
Prunus serotina Ehrh.	Black Cherry
Prunus nigra Ait.	Canada Plum
Cleditsia triacanthos L.	Honey Locust
Acer sp.	Maple
Cornus sp.	Dogwood
Fraxinus sp.	Ash
Viburnum lentago L.	Sheepberry

SHRUBS

Smilax hispida Muhlenberg	Hispid Greenbrier
Salix sp.	Willow
Corylus americana Walter	American Hazelnut
Ribes Cynosbati (Linnaeus) Miller	Pasture Gooseberry
Hamamelis virginiana L.	Common Witch-hazel
Physocarpus opulifolius (L.) Maximowicz	Common Ninebark
Spiraea tomentosa L.	Hardhack
Spiraea alba DuRoi	Meadow Spiraea
Rubus occidentalis L.	Common Blackcap Raspberry
Rubus flagellaris Willdenow	Northern Dewberry
Rubus allegheniensis Porter	Allegheny Blackberry
Rosa setigera Michaux	Prairie Rose
Rosa sp.	Rose
Aronia melanocarpa (Michaux) Elliott	Black Chokeberry

SHRUBS (Continued)

Zanthoxylum americanum Miller	Common Prickly-ash
Rhus copallina L.	Shining Sumac
Rhus glabra L.	Smooth Sumac
Rhus canadensis Marshall	Fragrant Sumac
Rhus radicans L.	Poison Ivy
Celastrust scandens L.	American Bittersweet
Rhamus lanceolata Pursh.	Lance-leaved Buckthorn
Vitis sp.	Grape, at least two species
Parthenocissus sp.	Virginia Creeper
Cornus sp.	Dogwood
Gaultheria procumbens L.	Wintergreen
Gaylussacia baccata K. Koch	Black Huckleberry
Vaccinium vacillans Kalm ex Torrey	Dryland Blueberry
Cephalanthus occidentalis	Common Buttonbush
Viburnum affine Bush	Missouri Viburnum
Berberis vulgaris L.	European Barberry

HERBS

Steironema quadriflorum (Sims) Hitchc.	Linear-leaf Yellow Loosestrife
Oenothera oakesiana	Oakes' Evening Primrose
Verbascum blattaria L.	Moth Mullen
Verbascum thapsus L.	Common Mullen
Agalinis purpurea (L.) Penn.	Large-flowered Agalinis
Agalinis tenuifolia (Vahl.) Raf.	Slender Agalinis
Verbena hastata L.	Blue Vervain
Prunella vulgaris L.	Common Self-heal
Pluchea petiolata Cass.	Inland Marsh-fleabane
Cirsium lanceolatum (L.) Hill	Spear Thistle

The above list was classified at odd times during the work on the experimental area and is not an attempt at a list in any way complete, but does serve to give some idea of the vegetation in the region where the work was done. References used were:

Schaffner, J. H.,	Field Manual of the Flora of Ohio and Adjacent Territory. 1928. R. G. Adams & Co., Columbus, Ohio.
Otis, H. O.	Michigan Trees, 1923. Univ. of Mich. Bulletin, New Series Vol. XXV, No. 5.
Deam, C. C.,	Trees of Indiana, 1921. Pub. No. 31, Dept. of Conservation, State of Indiana.
Deam, C. C.,	Shrubs of Indiana. 1924. Pub. No. 44, Dept. of Conservation, State of Indiana.

TABLE NO. 4

INJECTION EXPERIMENTS UNDERTAKEN AT MAUMEE, OHIO. AUGUST-SEPTEMBER 1930

Chemical Used	Treatment Given	Bush Number
Sodium Chlorate	2	160,161,165
Water Paste	5	162,163
	1	164
Sodium Chlorate Saturated Solution	6	166,169
Arsenic Oxide	5	170
Water Paste	2	171
	4	172
Arsenic Oxide Saturated Solution	6	167,168
Bismuth Subbenzoate	2	173
Glycerine Paste	4	174
	1	175
	5	176
Sodium Cyanide	4	177
Glycerine Paste	1	180
	2	182
	5	183
	7	184
Sodium Cyanide	3	178,181
Saturated Solution	6	179
Copper Complex	2	186
Glycerine Paste	4	187
	1	188,191
	5	192
Copper Complex	3	185,189
Saturated Solution	6	190,197
Atlacide	1	193,200
Glycerine Paste	7	203,204
Copper Complex	7	194,195
Glycerine Paste	5	196
	4	198
	2	199
Sulphur Dioxide Solution 8%	6	205
Zinc Ammonium Chloride	5	206,209
Glycerine Paste	4	210
	2	211
	1	212
	7	213
Sodium Sulphate	3	264,265
Saturated Solution	6	268,269
Kerosene	2 (6 cc. Used)	278
No Glycerine	1 (5 cc. Used)	279,280
	2 (20 cc. Used)	281
	3	282
Ferrous Ammonium Sulphate	4	283,287
Glycerine Paste	5	284,285
	2	288,290
	1	291,292
	7	295,296
Ferrous Ammonium Sulphate	3	286,289
Saturated Solution	6	293,294
Pitch Oil	3	297,301
No Glycerine	4	298,299
	2	300,302
	1	303,304
Sodium Chlorate	2	305,306
Water Paste	7	307,308
Sodium Chlorate	3	309,310
Saturated Solution	6	311
Sodium Chlorate	2	312,314
Glycerine Paste	5	313
	1	315,316,319
	4	317,318
Formaldehyde	3	320,321
No Glycerine	1	322,323
	2	324
	4	325
Sodium Chloride	1	326,329
Glycerine Paste	5	330,331
	4	332,333
	2	334,335
Sodium Chloride	6	336,337
Saturated Solution	3	328,327
Silver Nitrate	4	218
Glycerine Paste	2	219
Silver Nitrate Saturated Solution	6	220
Furfural	3	221,222
	6	223
	1	224
	5	225
Copper Sulphate	7	228,229
Glycerine Paste	1	230,232
	5	231
	4	233
	2	234
Copper Sulphate	3	226,227
Saturated Solution	6	235
Sodium Nitroprusside	4	236,238
Glycerine Paste	1	237
	5	239
	7	242
Sodium Nitroprusside	3	240
Saturated Solution	6	241
Sodium Nitrite	5	243
Glycerine Paste	2	245
	4	246
	1	247
	7	249
Sodium Nitrite	6	244
Saturated Solution	3	248
Mercuric Chloride	5	252,256
Glycerine Paste	1	253,261
	4	254,258
	2	257,259
	7	262,263
Mercuric Chloride	3	250,251
Saturated Solution	6	255,260
Sodium Sulphate	7	266,267
Glycerine Paste	5	270,272
	1	271,273
	2	274,277
	4	275,276
Phenol	4	338
Glycerine Liquid	3	340
	5	341
	2	342
	1	344
Phenol + Water	3	339
Saturated Solution	6	343
Potassium Dichromate	1	349
Glycerine Paste	5	346
	4	347
	2	348
Potassium Dichromate Saturated Solution	6	345
Cadmium Chloride	5	350,359
Glycerine Paste	1	351
	4	353
	2	355
Cadmium Chloride	3	352
Saturated Solution	6	354
Ammonium Chloride	4	356
Glycerine Paste	1	357,361
	2	360
Ammonium Chloride	3	358
Saturated Solution	6	360
Sodium Tetraborate	5	362
Glycerine Paste	2	363
	1	364
	4	370
Sodium Fluoride	5	365
Glycerine Paste	1	366
	2	367
	4	369
Phenol in Kerosene	See Spray Chart	370
		371
Sodium Chlorate Saturated Solution	6	372

LEGEND FOR TREATMENT GIVEN

1. Bush cut off through crown, groove cut in crown, filled with paste. (1-5 gms.)
2. Bush cut off through crown, hole bored with 3/16" bit and filled with paste. (1-5 gms.)
3. Crown lacerated and large roots exposed, small amount of saturated solution (2-4 cc.) applied.
4. Top left intact, hole bored into crown and filled with a paste. (1-5 gms.)
5. One stem cut off at crown, groove cut in crown and filled with a paste. (1-5 gms.)
6. One stem cut off, fitted on a piece of rubber tubing and rubber tubing filled with a saturated solution. (5-20 cc.)
7. Grubbed out the crown and applied paste to ends of roots. (5-20 gms.)

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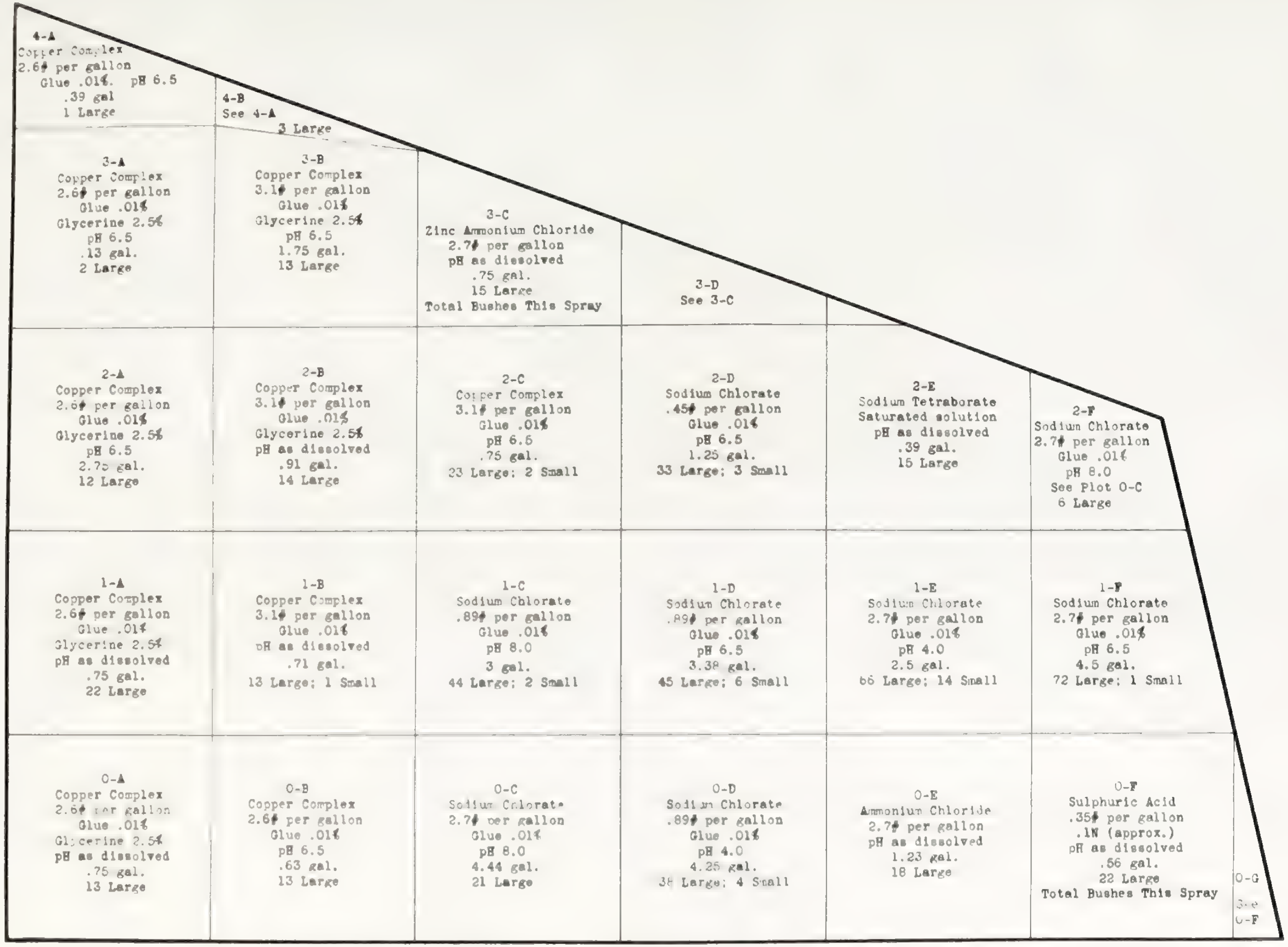

BARBERRY CHEMICAL EXPERIMENTAL AREA I

MAUMEE, OHIO

SCALE 1" ½" 0 1" = 1 CHAIN

ORIGINAL MAP BY DRAPER, SEPT. 27, 1930
COPY BY W. V. B., OCT. 17, 1930

LEGEND

LARGE BUSH - ONE MARKED WITH PIECE OF CLOTH

SMALL BUSH - ONE MARKED WITH WIRE STAKE

SOUTHWEST CORNER STAKE HAS PLOT NUMBER AND SPRAY FORMULA

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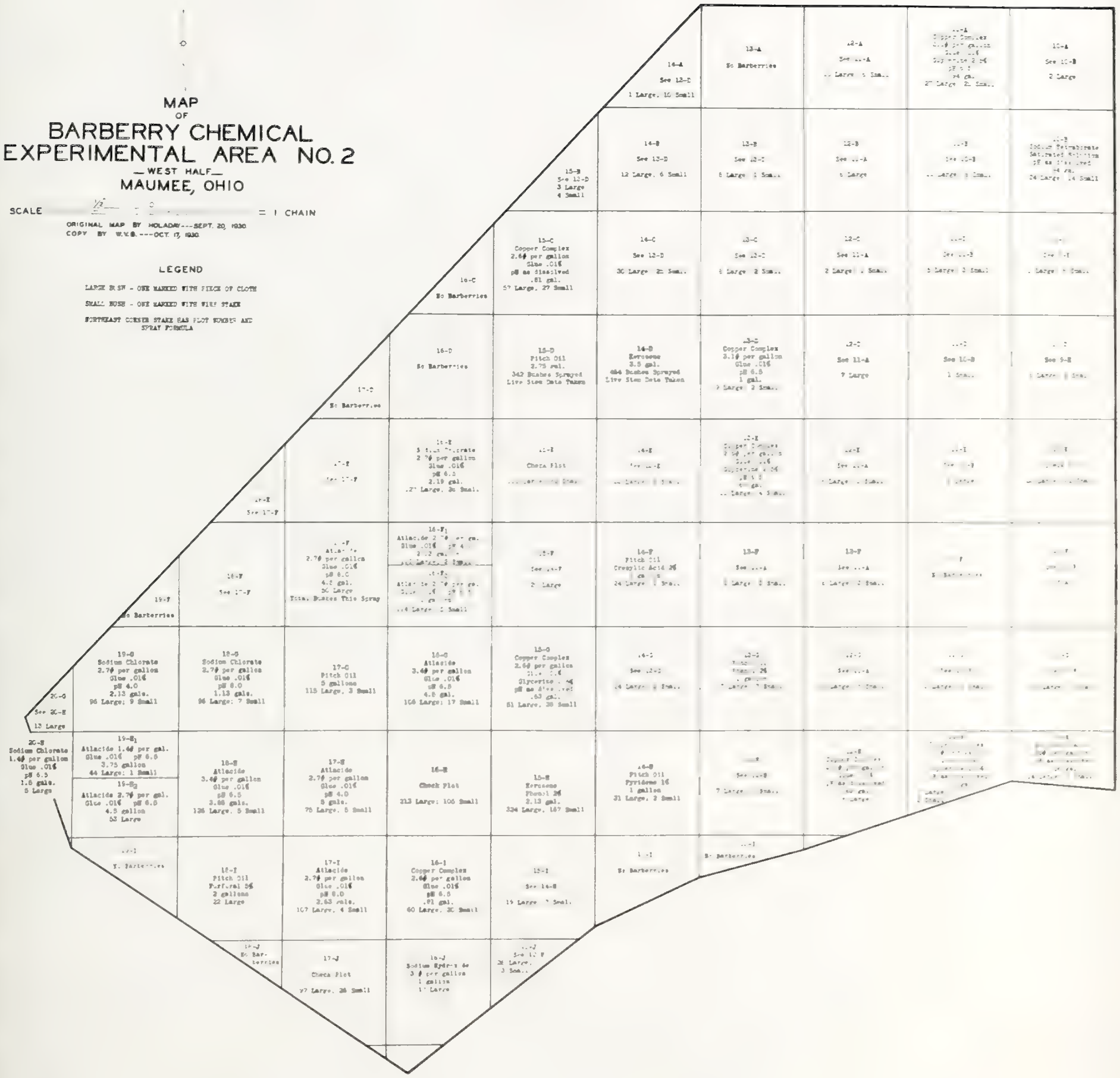

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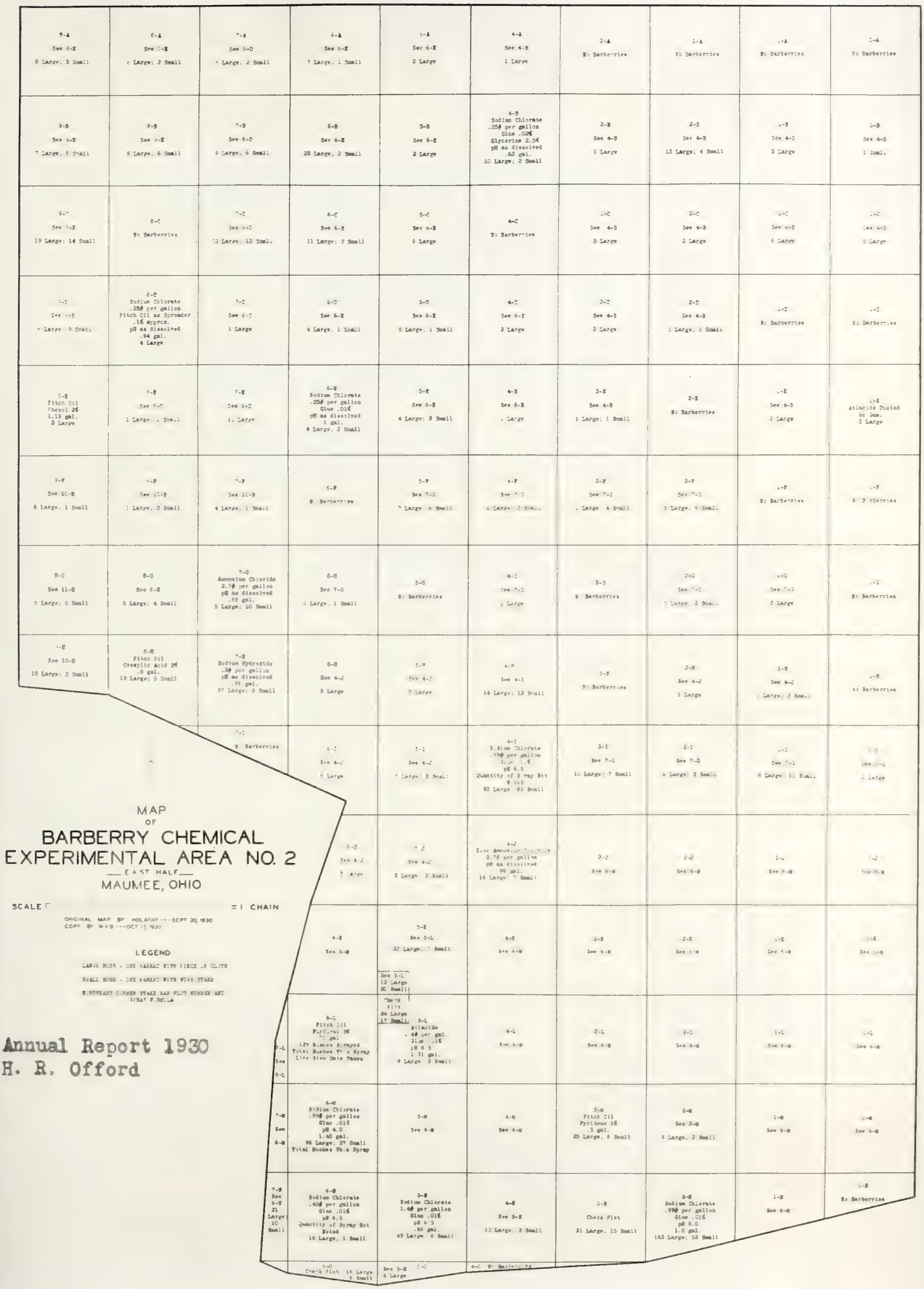

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TENTATIVE CONCLUSIONS DRAWN FROM OBSERVATIONS OF FIELD EXPERIMENTS

Common barberry appears to be rather susceptible to three types of chemical treatment and lends itself, if these observations are finally proved to be true, to a flexible program of chemical eradication. The following chemical methods are tentatively suggested:

1. For eradication of mature plants where they occur in great numbers: Sodium chlorate or sodium chlorate and calcium chloride mixture (Atlacide) applied as a spray with blister rust knapsack sprayer.

2. For eradication of mature plants where they are few and scattered: Application of strong aqueous solution of copper complex to scarified crown or the same chemical applied to end of a freshly cut stem by the rubber tube method.

3. For eradication of seedlings and small resprouts: Sodium chlorate or sodium chlorate and calcium chloride mixture (Atlacide) applied as a spray with blister rust knapsack sprayer. In light, sandy soil seedlings might be hand pulled.

4. For eradication of barberries from private estates and gardens: Application of strong aqueous solution of copper complex to scarified crown or the same chemical applied to end of a freshly cut stem by the rubber tube method.

It should be borne in mind that these tentative suggestions are made on the basis of quantity and cost of chemical, ease of handling, and effectiveness of the method. At this stage of the work the writer cannot temper these suggestions with an adequate appreciation of the practical difficulties faced by the Office of Barberry Eradication. The program of ecological work which is being undertaken on the Maumee area is being watched by the writer with considerable interest. Before a final decision is reached regarding the practicability of chemical methods for barberry eradication the influence of chemicals on the germination of barberry seed should be considered. Is it desirable to stimulate germination of barberry seed and thus rapidly remove them from the eradication picture or should their germination be depressed to the practical minimum by judicious selection of chemicals? It has been observed that Ribes seedlings which come up shortly after parent bushes have been chemically destroyed are abnormally large. While it has not been proved that chlorate stimulates germination and subsequent growth of Ribes, a considerable number of field observations point very strongly to that possibility. With this point in mind, therefore, considerable interest is attached to next season's observations of barberry on the Maumee plots. Following a careful check of the 1930 experiments, it will be possible to decide more definitely on the merits of the four methods just described and to plan experiments at that time which will

mould these chemicals and methods more closely to the form most desirable to the needs of the Barberry Office.

[illegible]

[illegible]

Supervision - - - [illegible]

Chemical work - - Ten Atta, [illegible], [illegible], [illegible] [illegible]

Morphological - - [illegible]

and

Physiological - - (d'Urcel) at Moscow.

Division of Work

The chemical work is to be divided between two [illegible] stations, Berkeley and Moscow, and the morphological work is to be undertaken at Berkeley. Physiological experiments such as necessary for chemical and morphological research are to be undertaken at Berkeley and Moscow.

Assignments

[illegible] (1) General supervision.
(2) Preparation of annual report.
(3) Preparation of [illegible] paper for publication in J.A.R.
(4) Preparation of [illegible] for following publication.
(5) Special research assignment.

Organization of light chamber studies. It is proposed [illegible] certain control chambers which the University of California is [illegible] to build, and use these control chambers for [illegible] under known conditions of light, temperature and humidity. [illegible] and morphological data will be obtained from the plants [illegible] and attempts made to correlate [illegible] and [illegible] of these plants grown under different ecological conditions [illegible] related to general susceptibility to chemical treatment.

[illegible] (1) Supervision of all work undertaken at Moscow.
(a) [illegible] propagation [illegible]
(b) Routine chemical analysis.
(c) Special research assignments [illegible] at Moscow.

[illegible]

PART III

OUTLINE OF INVESTIGATIVE WORK

PROJECT 2.3-1, FOR PERIOD SEPTEMBER, 1930 - MAY, 1931

Personnel

Supervision - - - H. R. Offord.

Chemical work - - Van Atta, d'Urbal, Draper, Keyser, Holsley and Vogtmann.

Morphological - - Webber, Patty, Quick,

and

Physiological - - (d'Urbal at Moscow).

Division of Work

The chemical work is to be divided between two experimental stations, Berkeley and Moscow, and the morphological work is to be undertaken at Berkeley. Physiological experiments such as necessary for chemical and morphological research are to be undertaken at Berkeley and Moscow.

Assignments

Offord: (1) General supervision.

(2) Preparation of annual report.

(3) Preparation of Nitella paper for publication in J. A. R.

(4) Preparation of field data for follow-up publication.

(5) Special Research Assignment.

Organization of light chamber studies. It is proposed to rent certain control chambers which the University of California is planning to build, and use these control chambers for growing Ribes and barberries under known conditions of light, temperature and humidity. Chemical and morphological data will be obtained from the plants thus grown and attempts made to correlate chemical and morphological characteristics of these plants grown under different ecological conditions as they are related to general susceptibility to chemical treatment.

d'Urbal: (1) Supervision of all work undertaken at Moscow.

(a) Greenhouse propagation Ribes and barberries.

(b) Routine chemical analysis.

(c) Special research assignments for all men at Moscow.

(2) Special Research Assignment.

The effect of chlorates on plant functions of respiration, transpiration and photosynthesis and the influence of chlorates on plant enzymes as specialized actions of these three plant functions.

The rapid disappearance of starch from the stems and roots of R. petiolare, a species of Ribes extremely susceptible to the action of chlorates, strongly suggests a direct or indirect action of the chemical on the stored carbohydrates. So far no direct experimental evidence has been procured which explains this phenomenon.

Van Atta: (1) In immediate charge of all chemical work at Berkeley and greenhouse propagation of Ribes and barberries at Berkeley.

(2) Proximate analysis of barberry.
(3) Special Research Assignment:

Studies in organic and inorganic complex salts of heavy metals with special reference to (a) heavy metal complex salts soluble in an oil of high penetrability for use as a spray on R. inerme and other Ribes now resistant to chlorate; (b) development of a practicable tool for the stem or crown injection of heavy metal complex salts.

The development of a complex salt of a heavy metal which is soluble in an oil of high penetrability but preferentially soluble in water is designed primarily for those Ribes which have a small area of leaf surface per foot of live stem. The oil is used as a carrier of the preferentially soluble complex across the suberized stem tissue. Subsequent ready translocation of the complex on the basis of non-reactivity with the plant water extractives is assumed.

Preliminary experiments undertaken on Ribes and barberries indicate that copper complex is unusually successful as a killing agent and moves extensively within the plant when injected or applied to incisions in the stems or crowns. This investigation is designed for the development of a practicable tool and the most satisfactory chemical for this type of work.

Draper: (1) Proximate analysis of Ribes.
(2) Special Research Assignment.

Investigations of organic compounds containing elements having unusual valencies involving possible slow change to higher or lower valencies under influence of light. Sodium chlorate, containing pentavalent chlorine, to be kept in mind as example of an inorganic compound of this type.

The effect of chlorates on plant functions of respiration, transpiration and photosynthesis and the influence of chlorates on plant enzymes as specialized actions of these life plant functions.

The rapid disappearance of starch from the stems and roots of R. petiolare, a species of Ribes extremely susceptible to the action of chlorates, strongly suggests a direct or indirect action of the chemical on the stored carbohydrates. So far no direct experimental evidence has been produced which explains this phenomenon.

Van Alta: (1) In immediate charge of all chemical work at Berkeley and greenhouse propagation of Ribes and barberries at Berkeley.

(2) Proximate analysis of barberry.
(3) Special Research Assignment

Studies in organic and inorganic complex salts of heavy metals with special reference to (a) heavy metal complex salts soluble in an oil of high penetrability for use as a spray on R. lucens and other Ribes now resistant to chlorates; (b) development of a practicable tool for the stem or crown injection of heavy metal complex salts.

The development of a complex salt of a heavy metal which is soluble in an oil of high penetrability but preferentially soluble in water is designed primarily for those Ribes which have a small area of leaf surface per foot of live stem. The oil is used as a carrier of the preferentially soluble complex across the suberized stem tissue. Subsequent ready translocation of the complex on the basis of non-reactivity with the plant water extractives is assumed.

Preliminary experiments undertaken on Ribes and barberries indicate that copper complex is unusually successful as a killing agent and moves extensively within the plant when injected or applied to incisions in the stems or crowns. This investigation is designed for the development of a practicable tool and the most satisfactory chemical for this type of work.

Draper: (1) Proximate analysis of Ribes.
(2) Special Research Assignment.

Investigations of organic compounds containing elements having unusual valencies involving possible slow change to higher or lower valencies under influence of light. Sodium chlorate, containing pentavalent chlorine, is to be kept in mind as example of an inorganic compound of this type.

Field experiments suggest that any chemical compound which is not immediately toxic or caustic and which is capable of slow oxidation or reduction within plant tissue will accomplish remote injury similar to sodium chlorate though no compound has yet been discovered which approaches in magnitude the effect produced by chlorates. This field will be examined in the light of d'Urbal's findings on the effect of chlorate on plant functions.

Keyser, Holaday and Vogtmann: (1) Routine laboratory work at Moscow and Berkeley at discretion of d'Urbal and Van Atta.

Webber: (1) In immediate charge of routine morphological work at Berkeley.
(2) Preliminary work on barberry according to methods established for Ribes.
(3) Special Research Assignment.

Palisade ratio and phloem to xylem ratio of Ribes and barberry with reference to general susceptibility of the several Ribes and the common barberry to chemical treatment.

Statistical examination of sections of the four Idaho Ribes have shown that R. petiolare, R. viscosissimum, R. lacustre and R. inerme are arranged accordingly in a decreasing order of susceptibility to chemicals when the palisade ratios of the respective species are considered. By palisade ratio is meant the numerical result obtained when the average length of palisade cells is divided by the thickness of leaf. Phloem to xylem ratio is being determined in the same way. Since the palisade ratio may be taken as an indication of the physiological activity of the plant, it may be possible to use this factor as an expression of a plant's susceptibility to chemical injury.

For purposes of morphological investigation the following division of species is suggested:

Quick: - R. cereum, R. nevadense, R. roezli, R. montigenum, R. lasianthum, R. triste.

Patty: - R. sanguineum and R. lacustre, Oregon; R. watsonianum, R. inerme and R. viscosissimum, California.

Webber: - Berberis vulgaris, R. bracteosum, R. erythrocarpum.

The literature on the external morphology and histology of Berberis vulgaris L. is being thoroughly reviewed by Webber. Following this the external morphology and histology of common barberry leaves, stems

and roots will be studied in detail, keeping in mind the points of special significance (listed below) which have been determined for Ribes. Alnus, Salix, Cornus and Rhamnus (all Idaho species) will also be examined in the light of histological factors shown by earlier work on Ribes to be most significant in regard to susceptibility to chemical treatment.

In the case of each Ribes species the following points should be investigated:

External Morphology

(1) Herbage production, including:
  (a) Leaf size.
  (b) Average number of leaves produced along main axis of current season's shoot.
  (c) Average number of leaves present along main axis of current season's shoot at date of collection.
  (d) Development of axillary buds on current season's shoots.
  (e) Size of current season's shoots. (Length and basal diameter.)

(2) Epidermal characters including:
  (a) Nature of trichomes (glands, simple hairs and prickles) and their abundance.
  (b) Stomatal number per sq. mm.
  (c) Stomatal size.
  (d) Hydathode number per leaf tooth.
  (e) Hydathode size.

(3) Relative development of major veins and petioles.

Histology

(1) Leaves.

For each leaf, cross sections of the leaf blade should be made at approximately the mid-point of the mid-rib. On such sections the following measurements should be made at a point free from large veins.

  (a) Leaf thickness.
  (b) Depth of upper and lower epidermal cells.
  (c) Thickness of outer epidermal walls.
  (d) Palisade depth.

Palisade ratios should be computed. The range of structural variation within the mesophyll of a given species should be noted.

Cross sections of old stems should be cut in such a manner that the cortex is retained. The development of tissues outside of the cambium should be observed in order to ascertain the feasibility of computing storage tissue indices for the various species. In regard to xylem structure the following points should be noted:

(a) Average width of annual rings.
(b) Distribution of vessels (ring porous or diffuse porous).
(c) Number of vessels in a given area. If species has ring porous wood, data should be obtained for spring and fall wood.
(d) Average maximum diameter of vessels in last formed annual ring.
(e) Texture of xylem elements other than vessels (fine, medium, coarse).

If a rapid examination of the above sections suggests the existence of specific differences in the amounts of storage tissue, the quantitative development and structure of pith and rays should also be studied.

Plant Material Collected and Proposed and Use to Which Such Material Will be Put

Starch Analysis: R. petiolare, R. viscosissimum, R. lacustre (Idaho). R. inerme, R. lacustre (Oregon); R. bracteosum, R. roezli, R. nevadense, R. erythrocarpum (Berberis vulgaris, data already available).

Tannin Analysis: Ribes ditto as for starch and Berberis vulgaris.

Proximate Analysis: Ribes ditto as for starch except R. erythrocarpum. Also R. lasianthum and R. inerme (Calif.) and Berberis vulgaris. Salix and Alnus sp. (Idaho).

Greenhouse Propagations: R. petiolare, R. lacustre, R. viscosissimum, R. inerme, R. roezli, R. nevadense, Berberis vulgaris.

Greenhouse propagation of Ribes and barberries for use as experimental plants in the course of chemical, morphological and physiological research to be undertaken at Berkeley and Moscow. In so far as is practicable work on Idaho Ribes will be undertaken at Moscow and work on California Ribes at Berkeley.

In order to speed up work on barberries, greenhouse work will be done at both stations.

Through the cooperation of the Department of Botany of the University of California, a Ribes garden one acre in extent is now being established in Strawberry Canyon, a half mile east of the campus. The purpose of the garden is twofold: (1) to establish under cultivation in one

(a) Average width of annual rings.
(b) Distribution of vessels (ring porous or diffuse porous).
(c) Number of vessels in a given area. If species has ring-porous wood, data should be obtained for spring and fall wood.
(d) Average maximum diameter of vessels in last formed annual ring.
(e) Texture of xylem elements other than vessels (fine, medium, coarse).

If a rapid examination of the above sections suggests the existence of specific differences in the amounts of storage tissue, the quantitative development and structure of pith and rays should also be studied.

<u>Plant Material Collected and Proposed Use to Which Such Material Will be Put</u>

<u>Starch analysis</u>: R. <u>petiolare</u>, R. <u>viscosissimum</u>, R. <u>lacustre</u> (Idaho). R. <u>inerme</u>, R. <u>lacustre</u> (Oregon); R. <u>divaricatum</u>, R. <u>roezli</u>, R. <u>cereum</u>, R. <u>erythrocarpum</u> (<u>Berberis vulgaris</u>, data already available).

<u>Tannin analysis</u>: Ribes ditto as for starch and <u>Berberis vulgaris</u>.

<u>Cellulose analysis</u>: Ribes ditto as for starch except R. <u>erythrocarpum</u>. Also R. [illegible] and R. <u>inerme</u> (Calif.) and <u>Berberis vulgaris</u>. Salix and Alnus sp. (Idaho).

<u>Greenhouse propagation</u>: R. <u>petiolare</u>, R. <u>lacustre</u>, R. <u>viscosissimum</u>, R. <u>inerme</u>, R. <u>roezli</u>, R. <u>cereum</u>, <u>Berberis vulgaris</u>.

Greenhouse propagation of Ribes and barberries for use as experimental plants in the course of chemical, morphological and physiological research is to be undertaken at Berkeley and Moscow. In so far as is practicable work on Idaho Ribes will be undertaken at Moscow and work on California Ribes at Berkeley.

In order to speed up work on material, greenhouse work will be done at both stations.

Through the cooperation of the Department of Botany of the University of California, a Ribes garden one acre in extent is now being established in Strawberry Canyon, a half mile east of the campus. The purpose of the garden is twofold: (1) to establish under cultivation in one

area a collection of Ribes which will be representative of the sub-groups within the genus; (2) to provide material for chemical and morphological tests for the purpose of noting how certain key factors vary for the different species as they continue to grow under somewhat similar ecological conditions.

The ground already has been ploughed, graded, fenced and water services have been installed. Five plants of each of the following species are now in the ground: *R. petiolare*, *R. lacustre*, *R. viscosissimum*, *R. inerme*, *R. roezli*, *R. nevadense* and *R. histrix*. It is further planned to establish typical brush species commonly associated with the various phylogenetic groups.

area a collection of Pines which will be representative of the sub-groups within the genus; (b) to provide material for chemical and morphological tests for the purpose of noting how certain key factors vary for the different species as they continue to grow under the same similar ecological conditions.

The ground already has been plowed, graded, fenced and water services have been installed. Five plants of each of the following species are now in the ground: P. echinata, [illegible], P. [illegible], P. Taeda, P. [illegible], P. serotina and P. glabra. It is further planned to establish typical trees species commonly associated with the various phylogenetic groups.

CHEMICAL SPRAY EXPERIMENTATIONS, CLARKIA, IDAHO

By
F. F. Staat
Agent

PURPOSES OF PROJECT
(As outlined in Annual Report, 1929)

1. To test the effectiveness, under actual field conditions, of any spray that had shown promise as a Ribicide in laboratory experiments or in small scale field experiments.

2. To determine the relationship between time of application during the day and degree of effectiveness of any given spray.

3. To determine seasonal effect on the toxicity of chemical to Ribes and the modifications of that seasonal effect caused by:

   a. Concentration of spray.
   b. pH value of spray.
   c. Presence of different hygroscopic agents.

Note: The use of spray "stickers" and the trial of fire-proofing materials for clothing, relative to the handling of sodium chlorate sprays, were reported upon in the 1929 annual report.

FIELD WORK UNDERTAKEN IN 1930

1. The various spray schedules followed in 1929 were checked for effectiveness in Ribes kill.

2. Halves of certain plots treated with $NaClO_3$, $NaClO_3 + CaCl_2$, and Atlacide were resprayed with the precise formulas used in 1929. Respraying was done as near last year's dates as possible. Sprays at pH 6.5 were employed for all experiments.

3. Copper complex sprays, pitch oil, Diesel oil, and combinations of these oils were tested for their toxic action in early season application on Ribes stems.

4. Four chemicals were tested by soil application to the root crowns of Ribes inerme.

STATUS OF CHECKING RESULTS OF 1929 FIELD SEASON

1. No attempt was made to check plots sprayed with copper complex during the field season of 1930, since it was plainly evident that the

CHEMICAL RIBES EXPERIMENTATION, CLARKIA, IDAHO

by

[illegible]

Agent

OBJECTIVES OF PROJECT

(As outlined in Annual Report, 1929)

1. To test the effectiveness, under actual field conditions, of any spray that has shown promise as a ribicide in laboratory experiments or in small scale field experiments.

2. To determine the relationship between time of application during the day and degree of effectiveness of any given spray.

3. To determine seasonal effect on the toxicity of chemical to Ribes and the modifications of that seasonal effect caused by:

a. Concentration of spray.
b. pH value of spray.
c. Presence of different hygroscopic agents.

Note: The use of spray "stickers" and the trial of fire-proofing materials for clothing, relative to the handling of sodium chlorate sprays, were reported upon in the 1929 annual report.

FIELD WORK UNDERTAKEN IN 1930

1. The various spray schedules followed in 1929 were checked for effectiveness in Ribes kill.

2. Halves of certain plots treated with $NaClO_3$, $NaClO_3 + CaCl_2$, and atlacide were resprayed with the precise formulas used in 1929. Respraying was done as near last year's dates as possible. Sprays at pH 8.5 were employed for all experiments.

3. Copper complex sprays, pine oil, Diesel oil, and combinations of these oils were tested for their toxic action in early season application on Ribes stems.

4. Four chemicals were tested by soil application to the root crowns of *Ribes inerme*.

STATUS OF CHECKING RESULTS OF 1929 FIELD SPRAYS

1. No attempt was made to check plots sprayed with copper complex during the field season of 1930, since it was plainly evident that the

most toxic of these sprays failed to kill more than 1/4 to 1/3 of live stem of R. petiolare, R. inerme or R. lacustre.

Because of lack of men and of the limited time, none of the sodium chlorate-magnesium chloride plots were checked upon in 1930. Cursory examinations of these plots indicated that these sprays were considerably less effective in their kills of Ribes stem than were the straight sodium chlorate and the Atlacide sprays. The results of checking on all other sprayed plots are shown in Tables No. 1 to 3 following.

2. In the checking of 37 out of 52 plots, an attempt was made to differentiate between results in Ribes live stem reduction by sprays, of morning, noon, and afternoon-sprayed time strips. No consistent results could be obtained for the following reasons:

a. Time strips could not be resurveyed as originally run in 1929 on account of the variations in width of time sections, the occasional removal of time stakes, and the total absence of blazed lines or other permanent marks of reference.

b. Ribes conditions were seldom, if ever, found uniform, but would vary on each time strip for every plot. All the R. lacustre or R. inerme of a plot were frequently found to be located on a single time strip; the work was further complicated by beaver activities in the reduction of R. petiolare and R. inerme live stem.

As a general observation it may be said that for all Ribes species encountered in the Clarkia work, the poorest time for spraying, from the standpoint of chemical effectiveness, appeared to be from 2:30 to 4:30 p.m. This is substantiated by field data, worked up into tables, but not incorporated into this report.

In the case of R. petiolare and R. inerme it was found that the most effective kills were made in the morning (8:00 or 9:00 to 11:00 a.m.), while with R. lacustre, sprays were most effective in their kills during midday (11:30 a.m. to 2:30 p.m.).

An attempt was made to differentiate between crew effectiveness and chemical effectiveness by subtracting the feet live stem of what was considered to be missed bushes from the total live stem secured which had survived the sprays. In this regard, crew effectiveness was found to be correlated closely with chemical effectiveness of the various sprays, for morning, midday and afternoon application; the least number of misses were found to occur in the morning, the most in the afternoon. The greatest number of misses were registered against R. lacustre, the least against R. petiolare, the ratio being about 3½ to 1 (live stem figures).

most toxic of these sprays failed to kill more than 1/4 to 1/3 of live stem of R. petiolare, L. laurus or R. lacustre.

Because of lack of men and of the limited time, none of the sodium chlorate-magnesium chloride plots were checked upon in 1951. Cursory examinations of these plots indicated that these sprays were considerably less effective in their kills of Ribes stem than were the straight sodium chlorate and the Atlacide sprays. The results of checking on all other sprayed plots are shown in Tables No. 1 to 6 following.

2. In the checking of 37 out of 52 plots, an attempt was made to differentiate between results in Ribes live stem reduction by sprays, of morning, noon, and afternoon-sprayed time strips. No consistent results could be obtained for the following reasons:

a. Time strips could not be resurveyed as originally run in line on account of the variations in width of time sections, the removal of time stakes, and the total absence of blazed lines or other permanent marks of reference.

b. Ribes conditions were seldom, if ever, found uniform, but would vary on each time strip for every plot. All the R. lacustre or L. laurus of a plot were frequently found to be located on a single time strip; the work was further complicated by beaver activities in the reduction of R. petiolare and L. laurus live stem.

As a general observation it may be said that for all Ribes species encountered in the Clearwater work, the poorest time for spraying, from the standpoint of chemical effectiveness, appeared to be from 2:30 to 4:30 p.m. This is substantiated by field data, worked up into tables, but not incorporated into this report.

In the case of R. petiolare and L. laurus it was found that the most effective kills were made in the morning (6:00 or 7:00 to 11:00 a.m.), while with R. lacustre, sprays were most effective in their kills during midday (11:30 a.m. to 2:00 p.m.).

An attempt was made to differentiate between crew effectiveness and chemical effectiveness by subtracting the feet live stem of what was considered to be missed bushes from the total live stem scored which had survived the sprays. In this regard, crew effectiveness was found to be correlated closely with chemical effectiveness of the various sprays for morning, midday and afternoon application; the least number of misses were found to occur in the morning, the most in the afternoon. The greatest number of misses were registered against R. lacustre, the least against R. petiolare, the ratio being about 6½ to 1 (live stem figures).

TABLE NO. 1

COMPARISON OF STRAIGHT $NaClO_3$ SPRAYS IN PER CENT KILL OF RIBES STEM ON PLOTS SPRAYED 1929 AND CHECKED 1930

Spray Formula	Plot No.	R. petiolare: Feet of Live Stem on Plots Before Spraying	R. petiolare: Per Cent of Live Stem Killed: Actual Measure-ment	R. petiolare: Per Cent of Live Stem Killed: Ocular Estimate	R. petiolare: No. Men Making Ocular Estimate	R. lacustre: Feet of Live Stem on Plots Before Spraying	R. lacustre: Per Cent of Live Stem Killed: Actual Measure-ment	R. lacustre: Per Cent of Live Stem Killed: Ocular Estimate	R. lacustre: No. Men Making Ocular Estimate	R. inerme: Feet of Live Stem on Plots Before Spraying	R. inerme: Per Cent of Live Stem Killed: Actual Measure-ment	R. inerme: Per Cent of Live Stem Killed: Ocular Estimate	R. inerme: No. Men Making Ocular Estimate	Date of Spraying 1929
	23(1)	12,464	76	61	4	101	24	23	3	22,447	61	35	4	July 11
$NaClO_3$ - 5% .45#	43(1)	4,483	** 98	86	4	4,139	** 78	45	4	375	** 80	74	1	July 26
per Gallon pH 6.5	62(1)	7,030	81	97	4	915	64	51	4					August 8
Glue	77(1)	15,552	86	80	8	781	47	55	7					August 23
Total Stem Weighted Average		39,529	83.3	77.7		5,186	70.9	46.8		22,822	61.3	55.6		
$NaClO_3$ - 10%	23	13,243	99	82	4	32	44	20	1	11,082	77	55	4	July 11
.89# Per Gallon	43	21,040	** 98	96	5	6,162	** 91	60	5	1,323	** 87	40	3	July 26
p^H 6.5	62	6,132	98-	98	6	826	72	75	6					August 8
Glue	77	11,572	83	82	8	500	24	23	8					August 23
Total Stem Weighted Average		52,007	92.3	91.2		7,520	## 84.3	59.4		12,405	## 78.1	53.4		
$NaClO_3$ - 5%	38(1)	1,750	93	79	4	631	36			33,117	40	38	4	July 23
.45# Per	57(1)	4,641	** 97	97	4	5,233	** 75	71	4					August 5
Gallon pH 4.0	72(1)	3,686	81	92	6	1,130	48	35	6					August 14
Glue	95(1)	13,121	* 71	71	6	1,288	* 35	35	6					September 3
Total Stem Weighted Average		23,198	79.5	80.1		8,282	62.1	57.8		33,117	40	38		
$NaClO_3$ - 10%	38	447	* 79	79	6	207	* 57	57	5	8,737	* 46	46	6	July 23
.89# per Gallon	57	5,264	** 99+	97	5	1,361	** 84	67	5	701	44	28	4	August 6
pH 4.0	72	3,332	93	94	6	1,786	77	67+	6					August 15
Glue	95	13,930	* 90	90	6	677	* 63	63	6					September 3
Total Stem Weighted Average		22,973	92.3	92		4,051	75.9	65.8		9,438	45.9	34.7		
	33(1)	5,650	92	82	4	83	19			27,506	32	41	4	July 16
$NaClO_3$ - 5%	52(1)	10,566	** 99	91	8	898	** 59	62	8					July 30
.45# per Gallon	67(1)	2,991	77	79	7	3,765	50	52	7					August 12
pH 8.0 Glue	86(1)	2,916	* 88	88	6	2,740	* 73	73	6	1,502	* 18	18	6	August 29
Total Stem Weighted Average		22,123	92.8	86.7		7,486	59.2	60.5		29,008	31.3	39.8		
$NaClO_3$ - 10%	33	533	* 91	91	5					8,867	* 52.0	52	5	July 17
.89# per	52	6,013	95	93	5	1,531	** 72	67	5					July 31
Gallon pH	67	16,109	** 97	96	6	1,990	44	44	6					August 12
8.0 Glue	86	4,788	* 83	83	6	1,515	* 34	34	6	886	* 74	** 74	6	August 29
Total Stem Weighted Average		27,443	94	93		5,036	49.5	48		9,753	54	54		

*Ocular estimate per cent kills used; only actual counts on live stem made.
**Best kills of schedule.
##Best kills of indicated chemicals in all 3 tables.
(1) Plots sprayed with a series of solutions added after original schedule was made up.
All but weighted average per cents rounded off to nearest whole number.

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TABLE NO. 2

COMPARISON OF ATLACIDE SPRAYS IN PER CENT KILL OF RIBES STEM ON PLOTS
SPRAYED 1929 AND CHECKED 1930

Spray Formula	Plot No.	R. petiolare: Feet of Live Stem on Plots Before Spraying	R. petiolare: Per Cent of Live Stem Killed: Actual Measurement	R. petiolare: Per Cent of Live Stem Killed: Ocular Estimate	R. petiolare: Number Men Making Ocular Estimate	R. lacustre: Feet of Live Stem on Plots Before Spraying	R. lacustre: Per Cent of Live Stem Killed: Actual Measurement	R. lacustre: Per Cent of Live Stem Killed: Ocular Estimate	R. lacustre: Number Men Making Ocular Estimate	R. inerme: Feet of Live Stem on Plots Before Spraying	R. inerme: Per Cent of Live Stem Killed: Actual Measurement	R. inerme: Per Cent of Live Stem Killed: Ocular Estimate	R. inerme: Number Men Making Ocular Estimate	Date of Spraying 1929
Atlacide -	44	11,534	** 97-	49	6	1,400	**61	32	6	3,684	55	39	6	July 26
5% .68# Per Gal-	63	12,168	90	80	7	4,650	52	40	7					August 9
lon pH 6.5 Glue	78	26,696	* 61	61	8	1,998	* 25	25	8					August 24
Total Stem Weighted Average		50,398	76.2	62.8		8,048	46.9	34.9		3,684	55	39		
Atlacide - 10% 1.36# Per	46	6,563	56	94	6	2,802	**60	60	6	2,692	**55+	56	6	July 27
Gallon pH 6.5	65	7,419	** 97+	97	5	1,623	47	55	4					August 10
Glue	80	10,319	* 65	65	8	644	*19	19	5	2,597	*20	20	7	August 24
Total Stem Weighted Average		24,301	80.4	82.6		5,069	50.6	53.2		5,289	37.8	38.3		
Atlacide -	39	484	68	70	6	527	**71	63	6	17,348	32	39	6	July 23
5% .68# Per Gal-	58	10,609	** 88	86	4	1,940	42	60	4	110	**45	20	1	August 6
lon pH 4.0 Glue	73	4,684	82	78	6	1,430	63	38	5					August 15
	96	15,773	* 45	45	6	1,303	*34	34	6					Sept. 3
Total Stem Weighted Average		31,450	65.4	64.1		5,200	48.7	47.7		17,458	32.1	38.9		
Atlacide -	41	10,400	* 96	96	7	2,559	*78	**78	7	898	*55	**55	7	July 24
10% 1.36# Per	60	5,025	* 96+	**96+	7	2,937	*76	76	4	860	*52	52	4	August 7
Gallon pH 4.0	75	33,347	* 83	83	5	1,635	*38	38	5					August 21
Glue	98	4,400	* 70	70	6	320	*46	46	6					Sept. 4
Total Stem Weighted Average		53,172	85.7	85.7		7,451	# 67.1	67.1		1,758	# 53.5	53.5		
Atlacide - 5% .68# Per Gal-	53	11,082	** 96	87	8	1,116	**66	50	8					July 31
lon pH 8.0	68	11,736	92	91	7	670	46	37	7					August 12
Glue	87	4,583	* 77	77	6	1,076	46	46	6					August 29
Total Stem Weighted Average		29,401	# 91.2	87.3		2,862	54.6	45.5						

* Ocular estimate per cent kills used; only actual counts on live stem made.
** Best kills of schedule.
\# Best kills of indicated chemical.
All but weighted average per cents rounded off to nearest whole number.

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TABLE NO. 3

COMPARISON OF $NaClO_3 + CaCl_2$ (MIXED) SPRAYS IN PER CENT KILL OF RIBES STEM ON PLOTS SPRAYED 1929 AND CHECKED 1930

Spray Formula	Plot No.	R. petiolare: Feet of Live Stem on Plots Before Spraying	R. petiolare: Per Cent of Live Stem Killed: Actual Measurement	R. petiolare: Per Cent of Live Stem Killed: Ocular Estimate	R. petiolare: Number Men Making Ocular Estimate	R. lacustre: Feet of Live Stem on Plots Before Spraying	R. lacustre: Per Cent of Live Stem Killed: Actual Measurement	R. lacustre: Per Cent of Live Stem Killed: Ocular Estimate	R. lacustre: Number Men Making Ocular Estimate	R. inerme: Feet of Live Stem on Plots Before Spraying	R. inerme: Per Cent of Live Stem Killed: Actual Measurement	R. inerme: Per Cent of Live Stem Killed: Ocular Estimate	R. inerme: Number Men Making Ocular Estimate	Date of Spraying 1929
	25(1)	9,163	84	70	4	37	30			7,283	** 69	37	4	July 12
$NaClO_3$ - 5% .45# Per Gallon $CaCl_2$	45(1)	13,618	** 96	68	6	3,081	** 62	38	6	6,019	64	38	6	July 27
.23# Per Gallon	64(1)	27,103	83	81	6	1,810	43	53	6					August 9
pH 6.5 Glue	79(1)	11,372	* 39	39	8	308	* 29	29	8	507	* 17	17	6	August 24
Total Stem Weighted Average		61,256	77.9	68.6		5,236	53.3	42.6		13,809	64.9	35.7		
$NaClO_3$ - 10%	25	4,014	95	79	4	126	23	20	1	9,549	48	43	4	July 13
.89# Per Gallon	45	27,029	** 98+	90	6	1,553	** 77	48	6	1,704	** 70	39	6	July 27
$CaCl_2$ .47# Per	64	13,646	92	95	5	2,986	66	68	5	649	42			August 9
Gal. pH 6.5 Glue	79	3,470	* 60	60	8	426	* 26	26	8	655	* 29	29	8	August 24
Total Stem Weighted Average		48,159	# 93.9	88.3		5,091	# 64.9	57.2		12,557	49.7	41.7		
	40(1)	10,743	83	49	4	159	37	53	2	11,727	38	32	4	July 24
$NaClO_3$ - 5% .45#	59(1)	9,743	** 93	86	6	1,415	** 66	45	6	2,698	** 44	30	6	August 6
Per Gallon $CaCl_2$	74(1)	6,871	88	87	6	1,371	42	36	6					August 15
.23# Per Gallon pH 4.0 Glue	97(1)	16,424	* 41	41	6	1,249	* 17	17	6					September 4
Total Stem Weighted Average		43,781	70.3	60.2		4,194	42.5	34		14,425	39.1	31.6		
$NaClO_3$- 10%	40	26,825	* 96+	** 96+	7	511	* 64	64	6	5,386	* 72	** 72	7	July 24
.89# Per Gallon	59	2,300	* 96	96	7	2,747	* 70	** 70	7	2,437	* 67	67	7	August 7
$CaCl_2$ .47# Per	74	16,397	* 69	69	5	256	* 57	57	5					August 21
Gal. pH 4.0 Glue	97	16,684	* 75	75	5	1,817	* 54	54	5					September 4
Total Stem Weighted Average		62,206	83.3	83.3	5	5,331	63.3	63.3		7,823	# 70.4	70.4		
	35(1)	5,425	93	71	4	2,785	60			18,500	35	25	4	July 20
$NaClO_3$ - 5% .45#	54(1)	15,362	88	89	7	2,225	** 66	53	7	268	** 48			August 3
Per Gallon $CaCl_2$	69(1)	6,580	** 98	94	6	1,438	31	27	6					August 13
.23# Per Gallon pH 8.0 Glue	88(1)	5,203	* 71	71	6	616	* 33	33	6	5,169	* 26	26	3	August 3[illegible]
Total Stem Weighted Average		32,570	88.1	84		7,064	53.6	48.7		23,937	33.2	25.5		

*Ocular estimate per cent kills used; only actual counts on live stem made.
**Best kills of schedule.
Best kills of indicated chemical.
(1) Plots sprayed with a series of solutions added after original schedule was made up.
All but weighted average per cents rounded off to nearest whole number.

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Such factors as varying field conditions, varying weather conditions, discomforts due to insects, and mental attitude of the men, no doubt accounted for the great discrepancies recorded for crew effectiveness from plot to plot. In order to complete the spraying schedules for 1929, the work during that season was no doubt performed at a rate detrimental to crew effectiveness.

3. Tables No. 1 to 3 inclusive are designed primarily to show seasonal differences in spray toxicity; they are also used as the basis for all tables following. Some explanation is deemed necessary to show the derivation of these field tabulations.

During the 1929 field season, approximately 30 different chemical sprays, varying either in plant killing components, in concentration, in hygroscopic agents, or in pH values, were used through four spraying cycles, of from two to three weeks apart, on half-acre plots covering the stream bottom of Merry Creek, and extending a short distance up the slopes. These treated plots were checked for chemical kill on Ribes stem by the two following methods.

a. A 100% bush reconstruction, i.e., foot by foot count of all originally sprayed live stem, dead stem, and new stem of Ribes was attempted on each half-acre plot.

b. An average of several men's ocular estimates of the per cent of kill of each Ribes species involved, was obtained. These estimates were based on the study of several representative sprayed bushes on each plot,- the general "killed" appearance over the whole plot also entering into each man's estimate.

The manner of reconstructing sprayed Ribes brush, in practice, worked out as follows: an actual count of all stem, both dead and alive, of smaller bushes was made, and the larger clumps were carefully estimated. Thus every Ribes bush on a plot entered into the result obtained for the chemical toxicity of the given spray, but per cents of kill by count were based solely on the total feet of Ribes stem involved, irrespective of plant size.

To show seasonal effect on the toxicity of chemical to Ribes, the following table is based on actual stem counts from Tables No. 1 to 3 preceding.

Only 36 plots were found to sustain R. inerme growth; therefore, no attempt has been made to tabulate the seasonal effects of chemical spray upon this species.

such factors as varying field conditions, varying weather conditions, discomforts due to insects, and mental attitude of the men, no doubt accounted for the great discrepancies recorded for crew effectiveness from plot to plot. In order to complete the spraying schedules for 1928, the work during that season was no doubt performed at a rate detrimental to crew effectiveness.

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The manner of reconstructing sprayed Ribes brush, in practice, worked out as follows: an actual count of all stem, both dead and alive, of smaller bushes was made, and the larger clumps were carefully estimated. Thus every Ribes bush on a plot entered into the result obtained for the chemical toxicity of the given spray, but per cents of kill by count were based solely on the total feet of Ribes stem involved, irrespective of plant size.

To show seasonal effect on the toxicity of chemical to Ribes, the following table is based on actual stem counts from Tables No. 1 to 3 preceding.

Only 32 plots were found to sustain R. inerme growth; therefore, no attempt has been made to tabulate the seasonal effects of chemical spray upon this species.

TABLE NO. 4

COMPARISON OF SEASONAL TOXICITY OF SPRAYS

Species	Spray	No. Plots	Average Per Cent of Live Stem Killed						
			July 11-17	July 18-24	July 25-31	Aug. 1-7	Aug. 8-15	Aug. 16-21	Aug 29 to Sept. 4
A. petiolare	$NaClO_3$	24	87.0	86.0	97.5	98.0	88.0	86.0	83.0
	Atlacide	17		82.0	93.0	92.0	90.5	77.0	64.0
	$NaClO_3$ + $CaCl_2$	20	89.5	91.0	97.0	98.0	90.0	71.0	62.5
	Totals or Averages	61	88.2	86.3	95.8	94.0	89.5	78.0	69.8
M. lacustre	$NaClO_3$	25	26.0	46.5	75.0	79.5	59.0	45.0	51.0
	Atlacide	17		74.0	63.0	59.0	52.0	30.0	42.0
	$NaClO_3$ + $CaCl_2$	20	26.5	54.0	69.5	67.0	45.5	37.0	35.0
	Totals or Averages	60	26.2	58.1	69.1	68.5	52.1	41.0	42.6

From the above it may be seen that for A. petiolare sodium chlorate sprays show a loss in average toxicity of only 4 per cent kill from July 11 to September 4, while the loss is 18 per cent for Atlacide and 27 per cent for sodium chlorate-calcium chloride sprays over this same period.

The toxicity of all sprays on A. petiolare increases with the advance of the season, the highest effectiveness being from July 25 to August 7. After the latter date, spray effectiveness gradually drops off, and decidedly breaks after August 15 in the case of Atlacide and sodium chlorate-calcium chloride sprays. The toxicity of straight sodium chlorate sprays appears to drop off a week earlier (August 7) and gradually declines to the end of the season.

The relationship of toxicity of spray to season is further brought out in Table No. 5 which is not based on a direct comparison of average kills on live stem, but is based upon a comparison of the number of plots upon which a relatively high toxicity was maintained. This pictures more graphically what may be expected from the various sprays as the season advances.

TABLE NO. 5

COMPARISON OF SPRAY TOXICITIES BY RIBES SPECIES

Spray	R. petiolare		R. lacustre	
	Toxicity of 80% to 100% Maintained		Toxicity of 80% to 100% Maintained	
	Per Cent of Plots	Period of Maintenance	Per Cent of Plots	Period of Maintenance
$NaClO_3$	83.3	July 11 - Sept. 4	56.5	July 25 - Sept. 4
Atlacide	64.7	July 18 - Aug. 21	47.1	July 16 - Aug. 16
$NaClO_3$ + $CaCl_2$	70.0	July 11 - Aug. 15	60.0	July 25 - Sept. 4

The above table clearly shows that the sodium chlorate sprays are more effective in their kills throughout the season on R. petiolare and R. lacustre live stem than are either atlacide or sodium chlorate - calcium chloride mixtures.

4. The toxicity of chlorate sprays to Ribes, as modified by (1) concentration, (2) pH, and (3) presence of different hygroscopic agents, is shown in the following table, based on weighted averages obtained from Tables No. 1 to 3.

TABLE NO. [illegible]

COMPARISON OF [illegible] TOXICITIES BY WEED SPECIES

Spray	S. petiolare		S. lacunatum	
	Toxicity of 80% to 100% Maintained		Toxicity of 80% to 100% Maintained	
	Per Cent of Plots	Period of Maintenance	Per Cent of Plots	Period of Maintenance
$NaClO_3$	63.3	July 11 - Sept. 4	56.3	July 20 - Sept. 4
Atlacide	33.7	July 18 - Aug. 21	47.1	July 14 - Aug. 18
$NaClO_3$ + $CaCl_2$	70.0	July 11 - Aug. 15	50.0	July 20 - Sept. 4

The above table clearly shows that the sodium chlorate sprays are more effective in their kills throughout the season on S. petiolare and S. lacunatum live stem than are either Atlacide or sodium chlorate - calcium chloride mixtures.

2. The toxicity of chlorate sprays to weeds, as modified by (1) concentration, (2) pH, and (3) presence of different hygroscopic agents, is shown in the following table, based on weighted averages obtained from tables No. 1 to 5.

TABLE NO. 6

COMPARISON OF TOXICITIES OF SPRAYS, MODIFIED BY CONCENTRATION, pH VALUE, AND PRESENCE OF DIFFERENT HYGROSCOPIC AGENTS FOR 1929 SEASON

(BASED ON CHECK COUNT ESTIMATES AND A FEW CHECK OCULAR ESTIMATES OF PER CENT KILLS ON RIBES STEM)

pH Value	Solution	R. petiolare						R. lacustre						R. inerme					
		$NaClO_3$		Atlacide		$NaClO_3$ + $CaCl_2$		$NaClO_3$		Atlacide		$NaClO_3$ + $CaCl_2$		$NaClO_3$		Atlacide		$NaClO_3$ + $CaCl_2$	
		Per Cent Kill	No. Plots	Per Cent Kill	No. Plots	Per Cent Kill	No. Plots	Per Cent Kill	No. Plots	Per Cent Kill	No. Plots	Per Cent Kill	No. Plots	Per Cent Kill	No. Plots	Per Cent Kill	No. Plots	Per Cent Kill	No. Plots
Neutral pH 6.5	10%	92.3	4	80.4	3	93.9	4	84.3	4	50.6	3	64.9	4	78.1	2	37.8	2	49.7	4
	5%	83.3	4	76.2	3	77.9	4	70.9	4	46.9	3	53.3	4	61.3	2	55.0	1	64.9	3
	Absolute difference in favor of 10%	9.0		4.2		16.0		13.4		3.7		11.6		16.8		-17.2		-15.2	
	Per cent increase in toxicity of 10% solution	10.8		5.5		20.5		18.9		7.9		21.8		27.4		-45.5		-30.6	
Acidic pH 4.0	10%	92.3	4	85.7	4	83.3	4	75.9	4	67.1	4	63.3	4	45.9	2	53.5	2	70.4	2
	5%	79.5	4	65.4	4	70.3	4	62.1	4	48.7	4	42.5	4	40.0	1	32.1	2	39.1	2
	Absolute difference in favor of 10%	12.8		20.3		13.0		13.8		18.4		20.8		5.9		21.4		31.3	
	Per cent increase in toxicity of 10% solution	16.1		31.0		18.5		22.2		37.8		48.9		14.7		66.7		80.0	
Basic pH 8.0	10%	94.0	4					49.5	4					54.0	2				
	5%	92.8	4	91.2	3	88.1	4	59.2	4	54.6	3	53.6	4	31.3	2			33.2	3
	Absolute difference in favor of 10%	1.2						- 9.7						22.7					
	Per cent increase in toxicity of 10% solution	1.3						-19.6						72.5					

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The following is a discussion of Table No. 6.

Ten per cent solutions give consistently better kills on all three Ribes species studied than do five per cent solutions. The general average of all pH 6.5 sprays shows 12.2 per cent better kill on R. petiolare and 16.2 per cent better kill on R. lacustre in favor of the 10 per cent solutions, and a 24.4 per cent in favor of the 5 per cent sprays in the case of R. inerme, due, no doubt, to the differences in the number of plots involved. The general average of all pH 4.0 sprays shows greater kills of live stem of 21.9 per cent on R. petiolare, 36.3 per cent on R. lacustre, and 53.8 per cent on R. inerme in favor of the 10 per cent solutions.

Sodium chlorate sprays, having a chlorate concentration equivalent to that in the other two types of spray, average 10.55 per cent better kill than Atlacide and 6.46 per cent better kill than sodium chlorate-calcium chloride on R. petiolare stem, and they average 31.54 per cent better kill than Atlacide and 26.93 per cent better kill than sodium chlorate-calcium chloride on R. lacustre. On R. inerme, sodium chlorate sprays average 26.3 per cent better kill than Atlacide, and but .4 per cent better kill than sodium chlorate-calcium chloride.

Data regarding the effect of pH on the effectiveness of chlorate sprays are so inconsistent and the differences so small in the case of pH 6.5 and 8.0 as to render deductions extremely tentative. If the data for plot 23(1) (part of the original area worked in 1928) be omitted, a small difference is shown in favor of the 5 per cent solution at pH 8.0 for the "count figure", while the "estimate figure" favors pH 6.5. Again if plot 23 (part of the original area worked in 1928) is not considered in the case of the 10 per cent solutions, and a comparison is made of the three ensuing series of chlorate sprays at pH 6.5 and 8.0, both "ocular figures" and "count figures" favor the pH 6.5. It should be kept in mind, however, that when dealing with an unbuffered sodium chlorate spray at an original pH of 8.0 that it would very soon be changed by atmospheric CO_2 to a slightly acid spray - while the pH of 6.5 would be made slightly more acid by this same reaction. On the basis of these experiments, therefore, no deductions can be safely drawn relative to the effectiveness of alkaline chlorate solutions on R. petiolare.

However, with the other two species involved, ocular estimates, based on weighted averages, show a 10 per cent solution of Atlacide, pH 4.0 to be the best killer of R. lacustre (67.1% kill), and that a 10 per cent solution of either Atlacide (53.5% kill) or of sodium chlorate-calcium chloride (73.4% kill) pH 4.0, was best on R. inerme, over the whole of the 1929 field season.

The following is a discussion of Table No. 6.

Ten per cent solutions give consistently better kills on all three Ribes species studied than do five per cent solutions. The general average of all pH 6.5 sprays shows 12.2 per cent better kill on *R. petiolare* and 16.2 per cent better kill on *R. lacustre* in favor of the 10 per cent solutions, and a 24.4 per cent in favor of the 5 per cent sprays in the case of *R. inerme*, due, no doubt, to the differences in the number of plots involved. The general average of all pH 4.0 sprays shows greater kills of live stem of 21.9 per cent on *R. petiolare*, 36.3 per cent on *R. lacustre*, and 63.8 per cent on *R. inerme* in favor of the 10 per cent solutions.

Sodium chlorate sprays, having a chlorate concentration equivalent to that in the other two types of spray, average 10.35 per cent better kill than Atlacide and 6.46 per cent better kill than sodium chlorate-calcium chloride on *R. petiolare* stem; and they average 31.54 per cent better kill than Atlacide and 25.96 per cent better kill than sodium chlorate-calcium chloride on *R. lacustre*. On *R. inerme*, sodium chlorate sprays average 46.5 per cent better kill than Atlacide, and but .4 per cent better kill than sodium chlorate-calcium chloride.

Data regarding the effect of pH on the effectiveness of chlorate sprays are so inconsistent and the differences so small in the case of pH 6.5 and 8.0 as to render deductions extremely tentative. If the data for plot 23(1) (part of the original area worked in 1928) be omitted, a small difference is shown in favor of the 5 per cent solution at pH 8.0 for the "count figure", while the "estimate figure" favors pH 6.5. Again if plot 23 (part of the original area worked in 1928) is not considered in the case of the 10 per cent solutions, and a comparison is made of the three ensuing series of chlorate sprays at pH 6.5 and 8.0, both "ocular figures" and "count figures" favor the pH 6.5. It should be kept in mind, however, that when dealing with an unbuffered sodium chlorate spray at an original pH of 8.0 that it would very soon be changed by atmospheric CO_2 to a slightly acid spray - while the pH of 6.5 would be made slightly more acid by this same reaction. On the basis of these experiments, therefore, no deductions can be safely drawn relative to the effectiveness of alkaline chlorate solutions on *R. petiolare*.

However, with the other two species involved, ocular estimates, based on weighted averages, show a 10 per cent solution of Atlacide, pH 4.0 to be the best killer of *R. lacustre* (67.1% kill), and that a 10 per cent solution of either Atlacide (53.6% kill) or of sodium chlorate-calcium chloride (70.4% kill) pH 4.0, was best on *R. inerme*, over the whole of the 1929 field season.

TABLE NO. 7

REPORT ON NEW WORK IN CHEMICAL SPRAY EXPERIMENTATION
CLARKIA, IDAHO, 1930

Plot No.	Treatment	Area Covered	Amount of Ribicide Used		Time Taken to Spray		Status of Work Additional Remarks
			Pounds	Gallons	Actual	Spread	
100-106	Copper complex sprays	7 (1/2 acre) plots		204			Sprays discontinued July 20, 1930, while on second series of applications. Observations August 1, 1930 and September 10, 1930 showed that most toxic of 4 new sprays tried, failed to kill out less than 20% of the Ribes.
116	Pitch oil, straight spray	1/2 acre		32			Plots 116-119 inclusive to be checked for toxicity of sprays in 1931.
117	Diesel oil, straight spray	1/2 acre		72			Had to be gone over twice due to poor job initially. Only 3/4 of ground covered second time over as oil supply ran out.
118	Pitch oil - 1 part by volume Diesel oil - 1 part by volume	1/8 acre		13			Spraying discontinued July 15, 1930 due to toxic action of pitch oil on men handling pumps.
119	Pitch oil - 1 part by volume Diesel oil - 4 part	1/4 acre		19			Spraying discontinued July 15, 1930 due to toxic action of pitch oil on men handling pumps.
109	$NaClO_3$ 2 pounds per gallon Atlacide 2-1/2 pounds per gallon	1/2 acre	466 112-1/2	233 45	22 hours 50 min.	7 days	Root crown experiment plots, 109-112 inclusive, to be checked for toxicity of chemicals on *R. inerme* root crowns 1931.
110	$Zn\ NH_4\ Cl_3$ 2 pounds per gallon	1/2 acre	740	370	29 hours 5 minutes	5 days	Leaves of willows withered and fell soon after treatment of plot. Two weeks after defoliation, green buds and new leaves were seen.
111	Cu. complex 2 pounds per gallon	1/6 acre	200	100	8 hours 30 minutes	2 days	Not completed
112	NaCl (ice cream salt) 2 pounds per gallon	5/12 acre	1,290	645	197 hours	9 days	Not completed because of lack of time and inclement weather.

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5. Ocular estimates of Ribes kill, based on weighted averages, were found to be conservative in 37 cases out of 44 for all 3 species studied, when compared with the count estimate figures appearing in Table No. 6. It was found that in the other 7 cases, the ocular estimate figures ran over the count estimate figures an average of 3.2 per cent (from 0.5% low to 8.5% high). Of these 7 cases, 4 appear under Atlacide sprays and the other 3 under straight sodium chlorate sprays. Referring to Table No. 2, it will be seen that the weighted averages of the ocular estimates of kill on R. <u>petiolare</u>, R. <u>lacustre</u> and R. <u>inerme</u> for 10 per cent Atlacide solution with pH of 6.5 are respectively 2.2 per cent, 2.6 per cent and .5 per cent greater than the corresponding weighted count averages for this spray formula. This was one of the last spray schedules to be checked and since the other 4 exceptions appear in spray schedules checked late in the season also, it may be inferred that the ocular method of checking as briefly outlined in this report has much to recommend it over the present accepted method of stem measurement and estimation. It was found that both estimating methods came closest to approaching the same figures on plots sprayed with Atlacide (spraying schedules checked last) and on R. <u>petiolare</u> species for the entire season. The ocular estimate method took decidedly less time than did the 100 per cent count method over every plot checked, and a great saving in man hours was shown, even though 6 or 8 men were used in the former method as against but 2 in the latter. Further experimentation and development of technique is needed before the ocular estimate method of checking can be recommended to take the place of the present laborious and tedious method of reconstructing sprayed Ribes brush.

SUMMARY

Sixty-two plots were checked by actual count and by ocular estimate for chemical and crew effectiveness, by an organized system of checking. Many plots were rechecked several times as a check on the accuracy of the methods in use. On the basis of this check, the per cent kill of Ribes stem by species is given in tabular form for 5 per cent and 10 per cent aqueous solutions of sodium chlorate, Atlacide, and a mixture of sodium chlorate and calcium chloride. Results show that sodium chlorate was more effective than Atlacide, and that Atlacide was more effective than the hygroscopic mixture of chlorate and chloride made up in the field. It was not possible to make an accurate separation of spray data for early, midday and late afternoon work, but general observations suggest that optimum toxicity is secured when the water table within the plant is highest, i.e., up to midday. Sodium chlorate sprays show the smallest (4 per cent) seasonal variation in toxicity. Atlacide and the hygroscopic mixture show, respectively, 18 per cent and 27 per cent differences over the period July 11 to September 4. A general falling off from optimum toxicity is observed for all sprays after August 15. No significant differences were observed among the

sodium chlorate sprays at pH values of 6.5 and 8.0 for R. petiolare. The strongly acid sprays at pH 4.0 were in general less effective than sprays at the more nearly neutral pH values of 6.5 and 8.0.

In undertaking to search for variations of the magnitude involved in the experiments herein described, the difficulties introduced by a semi-commercial scale of spraying and uncontrollable field factors were not adequately appreciated. After a systematic series of checks had been made on the methodology of data taking it was apparent that data could not be taken with sufficient accuracy to justify any conclusions unless differences were 10 per cent or better. This should be kept in mind when results of the experiments are being examined.

RECOMMENDATIONS FOR FUTURE WORK

Work contemplated for the 1931 field season includes:

1. A check for effectiveness in Ribes kill and for efficiency of application on all "half plots" which were resprayed in 1930, and on all oil-sprayed and root crown application plots inaugurated in 1930.

2. Continuation and further trial of ribicides, using suitable methods and equipment in the soil application to root crowns of R. inerme.

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RECOMMENDATIONS FOR FUTURE WORK

Work contemplated for the 1951 field season includes:

1. A check for effectiveness in Ribes kill and for efficiency of application on all "half plots" which were resprayed in 1950, and on all oil-sprayed and root crown application plots inaugurated in 1950.

2. Continuation and further trial of herbicides, using suitable methods and equipment in the soil application to root crowns of R. inerme.

STUDIES IN EFFECTIVENESS OF CONTROL, 1930

By

H. N. Putnam

Associate Pathologist

The general purpose of this project is to determine the effectiveness of Ribes suppression in pine protection. Studies made with this general purpose in mind fall naturally into two groups, as follows: (1) studies on growth and regeneration of Ribes following eradication work, and (2) the effect of known amounts of Ribes per acre in spreading and intensifying blister rust.

It is hoped that ultimately we will have facts and data on which decisions can be made relative to the degree protection has been afforded a pine stand.

The work on this project was carried on in 1930 in a manner generally similar to that in 1929, which was chiefly by means of permanent plots to study the future of the Ribes following eradicative efforts, and to study the effect of Ribes left after eradication as an agent in pine infection. In addition to the above mentioned permanent plot studies, a system of disease surveys was inaugurated for the purpose of obtaining impartial quantitative values of infection both on Ribes and pines. A further study was started in 1930. This was an attempt to correlate weather conditions, particularly relative humidity, with intensity of infection.

The progress of the work done on Project 4.2 is shown in the following list of individual reports.

1. Checking Ribes Eradication Work at Savenac Nursery, Haugan, Montana, 1930.
2. Checking for Ribes on Areas in Idaho on Which Ribes Eradication Work was Done, 1924-1930.
3. Progress Report on Cheekye Plot Studies, 1930, Cheekye, B.C.
4. Progress Report on Studies of the Relative Susceptibility of *Pinus monticola* and *P. strobus* Growing Under Western Conditions, 1930.
5. Progress Report on Newman Lake Infection Study, Newman Lake, Washington, 1930.
6. Spread of the Rust Study, Chico, Washington, 1930.
7. Blister Rust Infection Surveys in Idaho, 1930.
8. Summary of Effectiveness of Control Studies, 1930.

CHECKING RIBES ERADICATION WORK AT SAVENAC NURSERY
HAUGAN, MONTANA, 1930

By
C. M. Chapman
Agent

INTRODUCTION

The Savenac Nursery at Haugan, Montana produces annually more western white pine planting stock than any other nursery in the world.

In view of the fact that white pine blister rust was spreading rapidly throughout the Pacific Northwest, it was decided in 1927 to survey Ribes conditions around the nursery with a view to protecting the pine planting stock from blister rust. Ribes eradication work started the following year and has been continued until the present time.

PURPOSE

The purpose of checking is to find out the quantity of live Ribes remaining following eradication in order to determine whether or not an area has been given protection against blister rust.

WORK DONE

Following the 1930 eradication work at Savenac Nursery, a 4 per cent check of the entire area worked was made.

RESULTS

The results of checking are shown in four ways as follows:

1. Ribes quantities left in each drainage.
2. Ribes classified by species and growth forms.
3. Ribes survival at different distances from the nursery.
4. Effect of brush conditions on Ribes population after eradication.

A. Ribes Quantities Left in Each Drainage.

In Table No. 1 is shown the Ribes conditions by drainages following eradication in 1930.

CHECKING RIBES ERADICATION WORK AT SAVENAC NURSERY HAUGAN, MONTANA, 1930

By

[illegible]
Agent

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METHODS

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A. Ribes Quantities Left in Each Drainage.

In Table No. 1 is shown the Ribes conditions by drainages following eradication in 1930.

TABLE NO. 1

RIBES PER ACRE REMAINING AFTER ERADICATION BY SPECIES AND DRAINAGES
SAVENAC NURSERY, HAUGAN,
MONT, 1930

Area	Milacres Studied	R. petiolare		R. inerme		R. lacustre		All Ribes	
		No.	* F.L.S.	No.	* F.L.S.	No.	* F.L.S.	No.	* F.L.S.
Dry Creek	560	12.5	32.0	42.9	46.6	10.7	22.3	66.1	100.9
Savenac Creek	3,100	13.6	10.9	8.1	35.4	2.2	2.9	23.9	49.2
Timber Creek	240	0	0	16.7	104.2	20.8	30.0	37.5	134.2
St. Regis River	7,030	0.3	2.5	4.6	13.0	0	0	4.9	15.5
Big Creek	2,000	2.0	0.4	12.0	14.5	8.0	3.2	22.0	18.1
Totals or Averages	12,930	4.0	5.4	9.4	21.7	2.7	2.7	16.1	29.8

* F.L.S. is "Feet of Live Stem."

From a study of Table No. 1 the following facts are indicated:

1. Practically 95 per cent of the total stream type area is located on Savenac Creek, Big Creek and the St. Regis River. These are the main streams of the area and are located nearest the nursery.

2. The smallest amount of Ribes live stem per acre after eradication was found on these three main streams.

3. On every stream R. inerme constituted the bulk of Ribes left after eradication.

4. The largest amount of R. lacustre after eradication was found on the two smallest streams, Dry Creek and Timber Creek.

B. Ribes Classified by Species and Growth Forms.

In Table No. 2 the Ribes left after eradication have been classified according to species and growth forms.

TABLE NO. 2

RIBES PER ACRE REMAINING AFTER ERADICATION BY SPECIES AND GROWTH FORMS, SAVENAC NURSERY, HAUGAN, MONTANA 1930.

Ribes Species	Surviving Bushes* No.	Surviving Bushes* F.L.S.	Seedlings No.	Seedlings F.L.S.	Sprouts No.	Sprouts F.L.S.	Total No.	Total F.L.S.
R. petiolare	1.4	4.6	1.3	.3	1.3	.5	4.0	5.4
R. inerme	4.8	19.0	.9	.2	3.7	2.5	9.4	21.7
R. lacustre	1.2	2.3	.8	.1	.7	.3	2.7	2.7
All Ribes	7.4	25.9	3.0	.6	5.7	3.3	16.1	29.8

*Surviving bushes = those bushes present before eradication and escaping eradication.

1. Over 80 per cent of the total feet of live stem per acre was classified as surviving Ribes live stem.

2. Surviving R. inerme made up the largest single Ribes factor, constituting nearly 64 per cent of the total live stem left after eradication.

3. An almost negligible amount of seedlings and a small quantity of sprouts were found on the area. From the rust standpoint seedlings and sprouts constitute a potential future menace, but not a particularly important present one because they are very small.

C. Ribes Remaining at Different Distances From the Nursery.

In Table No. 3 the Ribes per acre have been classified into zones of different distances from the nursery. The locations of the zones are shown on the accompanying map.

TABLE NO. 3

RIBES FEET OF LIVE STEM PER ACRE REMAINING AFTER ERADICATION BY SPECIES AND ZONES, SAVENAC NURSERY, HAUGAN, MONTANA, 1930.

Zone	Distance from Nursery in Chains	Estimated Acres of Stream Type	Number of Milacres	Feet of Live Stem Per Acre			
				R. pet.	R. iner.	R. lac.	Total Ribes
1	0-20	91.5	3,660	7.1	19.0	1.6	27.7
2	20-40	67.7	2,400	3.6	23.8	5.2	32.6
3	40-60	132.0	5,030	2.6	20.6	1.2	24.4
4	60-80	52.0	1,820	12.2	27.0	5.4	44.6
Totals or Averages		343.2	12,930	5.4	21.7	2.7	29.8

The following facts are indicated from an examination of Table No. 3.

1. There is not a wide variation in amounts of live stem left per acre at different distances from the nursery.

2. Again the relative abundance of *R. inerme* is demonstrated. The smallest amount of *R. inerme* per acre is greater than that of any combination of single amounts of the other two species per acre.

3. In Zone 1 Ribes were found at the rate of 27.7 feet of live stem per acre, a relatively small amount. However, Ribes at this average rate occurred on 91.5 acres of stream type, giving a calculated total of 2,535 feet of live stem present in the stream type. A glance at the map shows that within Zone 1 Savenac Creek stream type borders the nursery longitudinally, resulting in a close association of pines in the nursery and Ribes in the stream type. This situation increases very much the potential danger from the relatively few Ribes present in Zone 1.

D. Effect of Brush Conditions on Ribes Population After Eradication.

In Table No. 4 there is shown a comparison of Ribes conditions where brush has been cut and piled and where it was undisturbed.

SAVENAC NURSERY AND VICINITY
HAUGAN MONTANA
U.S. DEPARTMENT OF AGRICULTURE
BLISTER RUST CONTROL OFFICE
BY C. CHAPMAN FEB 1931 FROM BLISTER RUST
CONTROL AND FOREST SERVICE SURVEYS
SCALE 0 10 20 30 40 CHAINS
LEGEND
LIMITS STREAM TYPE ERADICATION
SAVENAC NURSERY CULTIVATED AREA
Zone No. 1
Zone No. 2
Zone No. 3
Zone No. 4
ST. REGIS RIVER
DEBORGIA
ROCK CREEK
YELLOWSTONE
R. 30W.
R. 29W.
T.19N.
MONTANA MERIDIAN

TABLE NO. 4

RIBES PER ACRE REMAINING AFTER ERADICATION ON AREAS OF UNDISTURBED BRUSH * COMPARED WITH RIBES ON AREAS FROM WHICH THE BRUSH WAS REMOVED,** SAVENAC CREEK, ST. REGIS RIVER AND BIG CREEK 1930.

Brush Condition	Ribes Species	Surviving Bushes		Seedlings		Sprouts		Total	
		No.	F.L.S.	No.	F.L.S.	No.	F.L.S.	No.	F.L.S.
Not cut	R. petiolare	1.0	4.1	.4	.1	0.0	0.0	1.4	4.2
Cut and piled	R. petiolare	2.1	1.3	3.9	.9	7.3	2.8	13.3	5.0
Not cut	R. inerme	5.1	20.0	.9	.2	3.2	2.4	9.2	22.6
Cut and piled	R. inerme	1.3	3.2	0.0	0.0	0.0	0.0	1.3	3.2
Not cut	R. lacustre	.4	.7	0.0	0.0	.5	.2	.9	.9
Cut and piled	R. lacustre	.9	1.3	3.9	.7	1.3	.6	6.1	2.6
Not cut	All Ribes	6.5	24.8	1.3	.3	3.7	2.6	11.5	27.7
Cut and piled	All Ribes	4.3	5.8	7.8	1.6	8.6	3.4	20.7	10.8

*Based on 9,850 milacres.
**Based on 2,330 milacres.

An examination of Table No. 4 reveals several interesting indications.

1. The chief effect of brush cutting and piling was apparently in reducing the R. inerme live stem. Since this Ribes has a habit of extending branches into other deciduous brush, it follows that the removal of this brush enables the eradicators to much more efficiently remove the R. inerme.

2. Evidence is not clear-cut in regard to the effect of brush disposal on seedlings and sprouts. There were larger amounts of R. petiolare and R. lacustre seedlings and sprouts associated with brush-cut than with brush-undisturbed conditions. On the other hand, no R. inerme seedlings and sprouts were found on the brush-cut areas.

E. Comparison of 1929 Eradication Work with that of 1930.

In Table No. 5 there is shown a comparison of Ribes quantities remaining after the 1929 and 1930 workings.

TABLE NO. 5

RIBES LIVE STEM PER ACRE REMAINING AFTER ERADICATION IN 1929 COMPARED WITH THAT IN 1930, SAVENAC NURSERY, HAUGAN, MONTANA

Year Checked	Milacres Studied	Feet of Live Stem Per Acre			
		R. petiolare	R. inerme	R. lacustre	Total Ribes
1929	8,546	84.0	1,252.0	16.0	1,352.0
1930	12,980	5.4	21.7	2.7	29.8

It is apparent that the 1930 eradication work at Haugan resulted in a very great reduction in Ribes per acre, particularly so in the case of R. inerme.

CONCLUSION

The nursery sanitation program at Savenac Nursery has succeeded in reducing large concentrations of highly susceptible Ribes to a few scattered small bushes. This excellent condition must be maintained by annual eradication work on the area. If this is not done, the Ribes now present will soon produce live stem sufficient to establish an abundance of blister rust in the nursery.

That there will be a large amount of blister rust on pines close to the nursery is a foregone conclusion. In 1930 rust was found on Ribes at four different locations in the immediate vicinity of the nursery. One location was only a few paces outside the designated protection area on Big Creek, while the other three locations were east of and within 3 miles of the nursery. The cankers resulting from these infections will, in all probability, produce aecia in 1933 in sufficient quantities to quite thoroughly infect the Ribes present around the nursery. It is a precaution necessary to the protection of the pines in the nursery that all Ribes be removed within the one mile protection zone.

It is apparent that the 1929 eradication work at Savenac resulted in a very great reduction in Ribes per acre, particularly so in the case of *R. lacustre*.

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The nursery sanitation program at Savenac Nursery has succeeded in reducing large concentrations of highly susceptible Ribes to a few scattered small bushes. This excellent condition must be maintained by annual eradication work on the area. If this is not done, the Ribes now present will soon produce live stem sufficient to establish an abundance of blister rust in the nursery.

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CHECKING FOR RIBES ON AREAS IN IDAHO ON WHICH RIBES ERADICATION WORK WAS DONE 1924-1930

By
H. N. Putnam
Associate Pathologist

INTRODUCTION

Checking for Ribes in 1930 after eradication was confined chiefly to the establishment and examination of permanent check plots on areas eradicated of Ribes in 1930, the examination of permanent check plots established in 1929, and a small amount of checking on areas eradicated of Ribes in 1924, 1925, 1926 and 1928.

The reason for the small amount of checking on 1930 worked areas was that the mopping up process, considered as part of the first working of stream type, was deferred until 1931. Consequently these areas were not considered completely worked and checking on such areas was delayed until the job is finished.

PURPOSE

The purpose of checking is to determine in a quantitative manner by means of permanent and temporary check plots the Ribes conditions existing on areas upon which Ribes eradication work has been performed. This involves a careful study of the growth and regeneration of Ribes on such areas particularly to find out the best time to perform the second eradication.

WORK DONE IN 1930

The checking done in 1930 falls naturally into three divisions: checking on eradication work done in (1) 1930, (2) 1929 and (3) 1924, 1925, 1926 and 1928.

[illegible]

CHECKING FOR RIBES ON AREAS IN IDAHO ON WHICH RIBES ERADICATION WORK WAS DONE 1926-1930

by

J. K. Putnam

Associate Pathologist

INTRODUCTION

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WORK DONE IN 1930

The checking done in 1930 falls naturally into three divisions: checking on eradication work done in (1) 1930, (2) 1929 and (3) 1926, 1927 and 1928.

Table No. 1 constitutes a tabular statement of the checking work done in Idaho in 1930.

TABLE NO. 1

AMOUNT OF CHECKING DONE IN IDAHO IN 1930

Area Checked	Year of Eradication	Permanent or Temporary Check Plots	Plots Number	Plots Milacres
Johnson, Shattuck, Cameron Creeks Potlatch Timber Protective Ass'n.	1930	Permanent	36	1,462
Parallel Creek, Clearwater Timber Protective Association	1930	Temporary	27	768
Potlatch Timber Protective Ass'n.	1929	Permanent	27	786
Clearwater Timber Protective Association	1929	Permanent	125	3,750
Big Creek, Priest Lake Timber Protective Association	1928	Temporary	8	2,418
Binarch, Lamb Creeks, Kaniksu National Forest	1928	Temporary	2	300
Binarch, Lamb Creeks, Kaniksu National Forest	1926	Temporary	3	700
Upper Priest River, Kaniksu National Forest	1925	Temporary	2	1,250
Upper Priest River, Kaniksu National Forest	1924	Temporary	3	1,420
Total			233	12,854

RESULTS OF CHECKING

A. Checking on Eradication Work Done in 1930

The results of checking by means of permanent check plots on eradication work done along three streams in the Potlatch Timber Protective Association is shown in Table No. 2.

TABLE NO. 2

EFFECT OF RIBES ERADICATION IN 1930 ON THE RIBES POPULATION ALONG THREE STREAMS IN THE POTLATCH TIMBER PROTECTIVE ASSOCIATION, IDAHO

Item	Cameron Creek		Shattuck Creek		Johnson Creek	
	Before Eradication	After Eradication	Before Eradication	After Eradication	Before Eradication	After Eradication
Number of plots studied	22	22	6	6	8	8
Number of milacres studied	850	850	166	166	448	448
Feet live stem per acre R. petiolare	41,705	2,257	46,964	2,795	29,197	1,302
Feet live stem per acre R. inerme	611	263	10,916	109	3,742	324
Feet live stem per acre R. lacustre	1,684	202	1,042	42	5,971	[illegible]
Feet live stem per acre R. viscosissimum	0	0	0	0	307	0
Feet live stem per acre - total Ribes	44,000	2,722	58,922	2,946	39,719	1,854
Per cent efficiency by feet of live stem		93.8		95.0		96.3

In partial explanation of the large amount of Ribes live stem surviving eradication as shown in Table No. 2, it must be mentioned that the mop-up work on these areas will not be done until 1931 and hence these areas are not yet completely worked. Furthermore a large amount of the surviving live stem of R. petiolare was under water when sprayed. As will be shown further on in this report, live stem under water when sprayed one year has been found to be almost wholly dead the following year, and this condition may obtain here next year.

Only one day's time was devoted to checking on 1930 worked areas in the Clearwater Timber Protective Association, and this checking

was only by means of temporary check plots. The results are shown in Table No. 3.

TABLE NO. 3

RESULTS OF CHECKING ON PARALLEL CREEK, CLEARWATER TIMBER PROTECTIVE ASSOCIATION, WORKED IN 1930

Number		Feet Live Stem Per Acre After Eradication		
Plots	Milacres	R. petiolare	R. lacustre	Total
27	768	21.0	125.4	146.4

B. Checking on Eradication Work Done in 1929

Under this heading there are reported the results of examining in 1930 the permanent check plots established in 1929 just before the eradication of Ribes took place that same year. There are also reported the results of a one-time spray application experiment started in 1929.

In Table No. 4 are shown the quantities of Ribes in 1930 on areas worked in 1929.

TABLE NO. 4

RIBES QUANTITIES PER ACRE IN 1930 ON AREAS WORKED IN 1929 ON THE POTLATCH AND CLEARWATER TIMBER PROTECTIVE ASSOCIATIONS, IDAHO

Timber Protective Association	Stream	Mil-acres Studied	R. petiolare Feet Live Stem Old*	R. petiolare Feet Live Stem New**	R. petiolare Feet Live Stem Total	R. inerme Feet Live Stem Old*	R. inerme Feet Live Stem New**	R. inerme Feet Live Stem Total	R. lacustre Feet Live Stem Old*	R. lacustre Feet Live Stem New**	R. lacustre Feet Live Stem Total	Total Ribes Feet Live Stem Old*	Total Ribes Feet Live Stem New**	Total Ribes Feet Live Stem Total	Per Cent Increase in Live Stem Since Eradication
	East Fork Potlatch Ck.	276	18.1	383.7	401.8	41.7	14.5	56.2	101.1	178.6	279.7	160.9	576.8	737.7	359
	Mallory Ck.	204	158.3	253.9	412.2	31.9	2.5	34.4	463.7	101.4	565.1	653.9	357.8	1,011.7	55
	Deep Ck.	306	93.1	41.5	134.6	0	0	0	410.8	77.5	488.3	503.9	119.0	622.9	24
Potlatch	All Streams	786	83.7	216.8	300.5	22.9	5.7	28.6	315.8	119.2	435.0	422.4	341.7	764.1	81
	South Fork Reed's Ck.	1,022	63.5	177.3	240.8	0	0	0	126.4	21.0	147.4	189.9	198.3	388.2	104
	North Fork Reed's Ck.	652	654.9	159.2	814.1	0	0	0	144.2	4.1	148.3	799.1	163.3	962.4	20
	Deer Ck.	886	222.7	142.3	365.0	0	0	0	29.2	8.5	37.7	251.9	150.8	402.7	60
	Alder Ck.	1,044	242.3	182.0	424.3	198.3	6.2	204.5	601.8	135.9	737.7	1,042.4	324.1	1,366.5	31
Clear-	Loop Ck.	146	648.6	244.5	893.1	0	0	0	270.5	62.3	332.8	919.1	306.8	1,225.9	33
water	All Streams	3,750	276.5	169.8	446.3	55.2	1.7	56.9	244.5	48.7	293.2	576.2	220.2	796.4	38

*By the term "old feet live stem" is meant that live stem which was present at the time of eradication and survived it.

**By the term "new feet live stem" is meant that live stem of old bushes, sprouts and seedlings, produced since the time of eradication.

Attention is directed to two important points in Table No. 4.

1. On every stream there has been an appreciable Ribes growth in 1930 since eradication in 1929. This increase varies from 20 per cent on the North Fork of Reed's Creek to 353 per cent on the East Fork of Potlatch Creek.

2. The largest increase in live stem in 1930 developed on *R. petiolare* on the East Fork of Potlatch Creek. In general *R. petiolare* showed the highest per cent gain in new live stem of any of the three Ribes species. The *R. petiolare* was sprayed and the other two species were hand pulled.

A study was made of the number of bushes per acre on the same stream types as those shown in Table No. 4 and the following facts were indicated:

1. On every stream checked there started after eradication large numbers of Ribes seedlings. These varied in number per acre from 83 on Deep Creek to 4,431 on the East Fork of Potlatch Creek.

2. On the average stream type in each Association the order of increasing abundance of bushes was: old bushes, sprouts and seedlings.

3. No seedlings or sprouts of *R. inerme* were found.

4. More seedlings and sprouts of *R. petiolare* and *R. lacustre* per acre were found on stream type in the Potlatch Timber Protective Association than in the Clearwater Timber Protective Association.

5. There were many more *R. petiolare* than *R. lacustre* seedlings. This was to be expected since before eradication there were more *R. petiolare* than *R. lacustre* bushes.

6. Although the Ribes live stem per acre on the lands of the two associations was approximately the same, there were over 4 times as many bushes per average acre in the stream type of the Potlatch Timber Protective Association than of the Clearwater Timber Protective Association. There is indicated a decided difference in the size of bushes. The average size of bushes in the two associations is shown in Table No. 5.

TABLE NO. 5

AVERAGE FEET OF LIVE STEM PER BUSH IN 1930 ACCORDING TO RIBES SPECIES AND GROWTH FORM ON AREAS WORKED IN 1929, POTLATCH AND CLEARWATER TIMBER PROTECTIVE ASSOCIATIONS.

Timber Protective Association	R. petiolare Feet Live Stem Per bush				R. lacustre Feet Live Stem Per Bush			
	Old Bush*				Old Bush*			
	Old** Growth	New Growth	Sprout	Seedling	Old** Growth	New Growth	Sprout	Seedling
Potlatch	3.29	1.20	0.42	0.08	4.87	0.76	0.22	0.11
Clearwater	6.82	2.00	0.63	0.11	10.54	1.73	1.67	0.13
Both Ass'ns.	6.41	1.91	0.58	0.09	8.44	1.37	1.16	0.11

*By "old bush" is meant a bush present before and surviving eradication work.
Sprouts and seedlings are those grown since eradication.
**By "old growth" on old bushes is meant that live stem present before and surviving eradication work, in contradistinction to "new growth" which is the live stem developed on an old bush since eradication work.

Attention is called to the following points in Table No. 5.

1. In every growth-form classification for each association the average bush of R. lacustre was larger than that of R. petiolare.

2. The average size of bush of either species in the stream type of the Clearwater Timber Protective Association was approximately twice that of the Potlatch Timber Protective Association.

3. The average size of the surviving bush was much larger in each species than that of sprouts or seedlings. The last named type of growth showed by far the smallest amount of live stem per bush.

4. The average size of one-year-old Ribes seedlings found in the stream type approximated one-tenth of a foot.

5. Approximately 23 per cent of the surviving live stem of R. petiolare and 14 per cent of the surviving live stem of R. lacustre in 1930 were composed of growth put on since eradication.

During the early part of the summer of 1929 R. petiolare bushes growing in the water of Deer Creek were sprayed when the stream was high. When the water receded it was observed that the Ribes live stem above the high water mark had been killed, but that that portion under water when sprayed was alive and had sent out numerous leaves. The mass effect of these live stems was that of a green carpet, some six inches thick.

To determine the effect of a chemical spray applied to R. petiolare when much of the live stem was under water, a 1/8 mile strip along the creek was laid out as a permanent plot. Pertinent data were taken in 1929 and the plot rechecked in the spring of 1930 with the following results.

3,957.0 Feet Live Stem were found in the fall of 1929 after one spray.
422.5 Feet Live Stem were found in the spring of 1930.

Another examination of the plot was made in the summer of 1930 with results similar to those in the spring.

Thus it was most gratifying to learn that 3,534.5 feet of live stem or nearly 90 per cent of that surviving eradication in 1929 had died during the winter of 1929-1930 without any additional effort on man's part.

C. Checking on Eradication Work Done in 1924, 1925, 1926 and 1928.

Under this heading there are reported the results of a very small amount of checking in 1930 on areas worked in the years shown. There are also reported the results of the 1930 examination of a seedling study started in 1926 on Binarch Creek.

In Table No. 6 there are shown the results of checking in 1930 on areas worked in 1924, 1925, 1926 and 1928.

TABLE NO. 6

FEET OF LIVE STEM PER ACRE OF RIBES SPECIES IN 1930 COMPARED TO AMOUNTS PER ACRE IMMEDIATELY FOLLOWING ERADICATION IN 1924, 1925, 1926 AND 1928, NORTHERN IDAHO

Year of Eradication	Area	Eradication Type	Mil-acres Studied	R. lacustre		R. viscosissimum		R. inerme		All Species		Per Cent Increase in Live Stem Since Eradication	Number Years Since Eradication
				* F.L.S. Surviving	F.L.S. 1930	* F.L.S. Surviving	F.L.S. 1930	* F.L.S. Surviving	F.L.S. 1930	* F.L.S. Surviving	F.L.S. 1930		
	Upper Priest River West of Camp No. 1	O.R.	720	0	0	1.9	97.4	0	0	1.9	97.4	5,030	6
	Upper Priest River near Rock Creek	D.R.	500	0	0	118.0	416.0	0	0	118.0	416.0	250	6
1924	Upper Priest River, Small Creek	Stream	200	0	38.5	0	0	0	0	0	38.5	-	6
	Upper Priest River Slope of Cedar Creek	O.R.	1,000	0	0	20.0	74.5	0	0	20.0	74.5	270	5
1925	Upper Priest River	Stream	250	104.0	844.0	0	0	0	0	104.0	844.0	710	5
	Binarch Creek Burn	O.R.	500	8.0	74.0	0	8.0	0	0	8.0	82.0	920	4
1926	Upper Lamb Creek	Stream	200	0	0	0	0	150.0	1,044.5	150.0	1,044.5	600	4
1926 Re-eradication in	Binarch Creek	Stream	100	0	95.0	0	0	0	0	0	95.0	-	2
1928	Lower Lamb Creek	Stream	200	0	0	0	0	25.0	239.5	25.0	239.5	860	2
	Big Creek C.O. 1925	O.R.	500	0	51.6	0	52.2	0	0	0	103.8	-	2
	Big Creek	Stream	668	0	1.5	0	0	28.7	142.9	28.7	144.4	400	2
	Fox Creek C.O.	O.R.	1,000	9.2	45.0	0	0	0	0	9.2	45.0	390	2
1928	Fox Creek	Stream	250	584.0	1,148.0	0	0	0	0	584.0	1,148.0	100	2

* By "F.L.S. surviving" is meant the actual live stem that escaped eradication, either as a missed bush, or incomplete pull. The term is used in contradistinction to "F.L.S. 1930" which designates the entire Ribes growth found in 1930 including surviving live stem.

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Data presented in Table No. 6 are based on too small an amount of sampling to be conclusive. However, certain facts are indicated.

1. Increases in amounts of live stem from the time of eradication to 1930 varied from 100 per cent increase in stream type worked in 1928 to 5000 per cent increase in open reproduction type worked in 1924.

2. In three instances, on stream types worked in 1924 and 1928, and on open reproduction type worked in 1928, no live stem definitely dating back to time of eradication was found by the checkers.

3. There was the least increase in Ribes live stem in a dense reproduction stand worked in 1924, and in an open pole stand worked in 1925.

4. The one important indication brought out in Table No. 6 is that the Ribes factor as existing after eradication work is not a fixed thing but is constantly increasing in quantity, doubling its live stem or increasing it several times two years or more after eradication, thus each year materially increasing the potential danger from blister rust.

From the viewpoint of determining the best time to rework an area the checkers kept a sharp lookout for Ribes fruits on bushes found on the check strips. No such fruits were seen. This is an important consideration, since the time of re-eradication is governed largely by the desirability of complying with two stipulations: (1) The area must be reworked before the bushes produce fruit; (2) the work on an area must be delayed until the bushes have all reached a size sufficient to be readily seen.

The data from which Table No. 6 was constructed were examined with reference to the origin of bushes found, that is, whether they were surviving bushes, new bushes from sprouts, or new bushes from seeds. The following points represent the conclusions from this analysis:

1. Of the 13 areas represented by check strips 10 showed bushes surviving eradication; 10 showed new bushes from sprouts, and 12, or all but one, showed new bushes from seeds. The only area showing no Ribes regeneration from seeds was one of dense reproduction worked in 1924.

2. New bushes, both from sprouts and seeds, established themselves quite readily on every area studied, except in the dense reproduction stand worked in 1924 where no bushes from seeds were found.

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2. New bushes, both from sprouts and seeds, established themselves quite readily on every area studied, except in the dense reproduction stand worked in 1924 where no bushes from seeds were found.

In Table No. 7 there are shown data on Ribes found on check strips on an area cut over in 1925. These data are included in Table No. 6.

TABLE NO. 7

CLASSIFICATION OF YOUNG RIBES BUSHES IN 1930 AS TO THE YEAR OF ORIGIN. AREA CUT OVER 1925. RIBES ERADICATED THEREFROM 1928, BIG CREEK, IDAHO.

Ribes Species	1926 Origin		1927 Origin		1928 Origin		1929 Origin	
	Number Bushes	Ave. F. L. S. Per Bush	Number Bushes	Ave. F. L. S. Per Bush	Number Bushes	Ave. F. L. S. Per Bush	Number Bushes	Ave. F. L. S. Per Bush
R. lacustre	0	0	6	0.43	51	0.45	1	0.1
R. viscosissimum	1	6.0	6	1.83	13	0.62	4	0.27

Attention is called to the following points in Table No. 7.

1. The majority of the seedlings of both species of Ribes found in 1930 originated in 1928. Presumably many seedlings came in immediately following logging in 1925, which were found and destroyed by the eradicators in 1928. Seedlings originating in 1928 and many of those starting in 1927 would have been too small to detect in 1928.

2. Judging from the fact that no seedlings of 1930 origin, and only a few of 1929 origin were found, it is apparent that the return of Ribes following the major disturbance of logging is about completed. In this instance germination of Ribes lasted over a period of five years from 1925 to 1929 inclusive.

3. The size of the average R. viscosissimum bush one to three years old was larger than that of R. lacustre of the same age.

D. Observations on the Survival of Ribes Seedlings

In Table No. 8 there are shown the results of a count of

In Table No. 7, there are shown data on Ribes found on check strips on an area cut over in 1925. These data are included in Table No. 6.

TABLE NO. 7

CLASSIFICATION OF YOUNG RIBES FOUND IN 1930 AS TO THE YEAR OF ORIGIN, AREA CUT OVER 1925. RIBES ERADICATED IN 1926. BIG CREEK, IDAHO.

Ribes Species	1926 Origin Number Bushes	1926 Origin Ave. F.L.S. Per Bush	1927 Origin Number Bushes	1927 Origin Ave. F.L.S. Per Bush	1929 Origin Number Bushes	1929 Origin Ave. F.L.S. Per Bush	1930 Origin Number Bushes	1930 Origin Ave. F.L.S. Per Bush
R. lacustre	0	0	2	0.40	51	0.13	1	0.1
R. viscosissimum	1	5.0	5	1.20	13	0.65	4	0.17

Attention is called to the following points in Table No. 7.

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2. Observations on the Survival of Ribes Seedlings

In Table No. 8 there are shown the results of a count of

R. lacustre seedlings in 1930 on a rock slide where the parent bushes were eradicated in 1926.

TABLE NO. 8

STUDY OF RIBES REGENERATION AFTER ERADICATION OF A DENSE CONCENTRATION OF R. LACUSTRE ALONG THE EDGE OF A ROCK SLIDE ON [illegible] CREEK, IDAHO.

Eradication of Parent Bushes - 1926. Checked in 1928, 1930

Year of Origin	Number of Bushes Found	
	Aug. 22, 1928	Sept. 4, 1930
1927	464	1
1928	1,717	16
1929		176
1930		13
Not known		276
Total	2,181	482

Before eradication there were 100 R. lacustre bushes present on this plot. When they were eradicated their locations were marked with stakes. In 1930 it was found that a small rock slide had covered the area formerly occupied by bushes numbered 1 to 7 inclusive. However, in former years very few seedlings had been found on this portion of the area.

From Table No. 8 it is apparent that a high mortality rate has obtained since 1928. Thus there was a loss of 1,[illegible] seedlings from 1928 to 1930. In other words the Ribes by number constituted in 1930 only 22 per cent of the number in 1928. The loss in 1930 of seedlings present in 1928 was still greater, since the 1930 figure includes many seedlings of 1929 and 1930 origin. The large number of seedlings of unknown age found in 1930 precludes any conclusions which might be based on the age of seedlings found in 1930. The only fact that is outstanding in this study is the high mortality among these R. lacustre seedlings growing on a rock slide.

In 1926 and again in 1930 observations were made of the Ribes present on the site of one eradication camp in 1924 and 19[illegible] in Upper Priest River Valley. This camp was on an alluvial flat under overmature cedar and hemlock. No quantitative checks were made of Ribes present either in 1926 or 1930.

R. lacustre seedlings in 1930 on a rock slide where the parent bushes were eradicated in 1926.

TABLE NO. 8

STUDY OF RIBES REGENERATION AFTER ERADICATION OF A LARGE CONCENTRATION OF R. LACUSTRE BUSHES IN THE BED OF A SMALL [illegible] CREEK [illegible], IDAHO.

Eradication of Parent Bushes - 1926. Checked in 1928, 1930

Year of Origin	Number of Bushes Found	
	Aug. 22, 1928	Sept. 4, 1930
1927	464	1
1928	1,717	16
1929		135
1930		13
Not known		270
Total	2,181	435

Before eradication there were 100 R. lacustre bushes present on this plot. When they were eradicated their locations were marked with stakes. In 1930 it was found that a small rock slide had covered the area formerly occupied by bushes numbered 1 to 7 inclusive. However, in former years very few seedlings had been found on this portion of the area.

From Table No. 8 it is apparent that a high mortality rate has obtained since 1928. There was a loss of 1,701 seedlings from 1928 to 1930. In other words the Ribes by number constituted in 1930 only 20 per cent of the number in 1928. The loss in 1930 of seedlings present in 1928 was still greater, since the 1930 figure includes many seedlings of 1929 and 1930 origin. The large number of seedlings of unknown age found in 1930 precludes any conclusions which might be based on the age of seedlings found in 1930. The only fact that is outstanding in this study is the high mortality among these R. lacustre seedlings growing on a rock slide.

In 1926 and again in 1930 observations were made of the Ribes present on the site of one eradication camp in 1924 and 1925 in Upper Priest River Valley. This camp site is an alluvial flat under overmature cedar and hemlock. No quantitative checks were made of Ribes present either in 1926 or 1930.

In the 1926 annual report on ecology work, page 135, the results of the 1926 observations are given. Around the cook tent there were found 4 R. viscosissimum. At the site of the methods tent there were found "probably 50 R. viscosissimum and 100 R. lacustre--- growing in this gravel-covered portion of the methods tent."

In 1930 a careful examination of this same camp site showed only 4 Ribes, all R. lacustre, one near the cook tent site, one near the camp fire site, one near a pup tent site, and one at the south end of the camp. This constitutes another example of the poor survival of Ribes seedlings. In this case, under shade of over-mature hemlock and cedar, there was no survival of R. viscosissimum to 1930, and only a very small survival of R. lacustre.

SUMMARY

In 1930 checking work was done in greater or less degree on areas in Idaho worked in 1930, 1929, 1928, 1926, 1925 and 1924. The one important conclusion that can be drawn from an analysis of the checking done in 1930 is that no matter what the Ribes species or eradication type may be, it is a certainty that the quantity of Ribes left after eradication does not remain constant but will increase greatly in after years and, if not reduced by a later working will constitute a grave menace to associated pines. In other words, there is no assurance that once protection to a pine stand is established, it will long remain so without future working of the area.

In the 1925 annual report on ecology work, page 1[illegible], the results of the 1925 observations are given. Around the cook tent there were found 4 R. viscosissimum. At the site of the [illegible] tent there were found "probably 50 R. viscosissimum and 300 R. lacustre growing in this gravel-covered portion of the [illegible] tent."

In 1930 a careful examination of this same camp site showed only 4 Ribes, all R. lacustre, one near the cook tent site, one near the camp fire site, one near a pup tent site, and one at the south end of the camp. This constitutes another example of the poor survival of Ribes seedlings. In this case, under shade of overmature hemlock and cedar, there was no survival of R. viscosissimum to 1930, and only a very small survival of R. lacustre.

Checking

In 1930 checking work was done in greater or less degree on areas in Idaho worked in 1930, 1929, 1928, 1926, 1925 and 1924. The one important conclusion that can be drawn from an analysis of the checking done in 1930 is that no matter what the Ribes species or eradication type may be, it is a certainty that the quantity of Ribes left after eradication does not remain constant but will increase greatly in after years and, if not reduced by a later working will constitute a grave menace to associated pines. In other words, there is no assurance that once protection to a pine stand is established, it will long remain so without future working of the area.

PROGRESS REPORT ON CHEEKYE PLOT STUDIES, 1930
CHEEKYE, B. C.

By
L. I. Joy
Junior Forester

INTRODUCTION

After the discovery in 1922 of large quantities of white pine blister rust infection at Cheekye, B. C., it was decided to establish a demonstration area in this vicinity where the activities of the disease could be studied under western conditions. In the spring of 1923 a circular plot with a 1,250-ft. radius was surveyed and the Ribes within this area were eradicated. Disease free white pine transplants were then planted in three rows along each of the 8 radii laid out at 45-degree intervals from north.

Destruction of this plot by fire in the fall of 1925 necessitated its reestablishment in the spring of 1926. White pine transplants were again planted along the 8 radii this time one row along each instead of 3.

PURPOSE

This plot was established in order to determine the maximum distance white pine blister rust will spread from native Ribes to western white pines under field conditions in the West. Two other subsidiary studies are: (1) the rate of killing by blister rust of young white pines, and (2) a determination of the survival of planted pines.

In 1930 an additional study was started with the planting on the plot of transplants of four species of pines. This is a study of the relative susceptibility of these species to blister rust.

WORK DONE AND RESULTS ACCOMPLISHED

In October, 1930, a crew composed of members of the permanent personnel spent several days on the following work: (1) planting 4,000 disease free white pine transplants on the area; (2) making a survey of the Ribes on a 2-chain wide strip around the circumference of the plot and on both sides of the extension of each radius beyond the circumference; (3) eradicating the Ribes from the plot; and (4) examining and taking data on the condition of pines planted in 1926.

A. Pine Planting

4,000 transplants, 1,000 each of *Pinus lambertiana*, *P. monticola*,

P. *flexilis* and P. *strobus* were planted in small blocks along each radius of the plot. At a point 2 chains from the plot center on the north, east, south and west radii, one unit of 40 pines, 10 of each species was planted. This was planted on the right side of each radius (when facing toward the circumference) and consisted of one row of each species started 10 links from the radius, with the pines and rows both spaced 5 links apart.

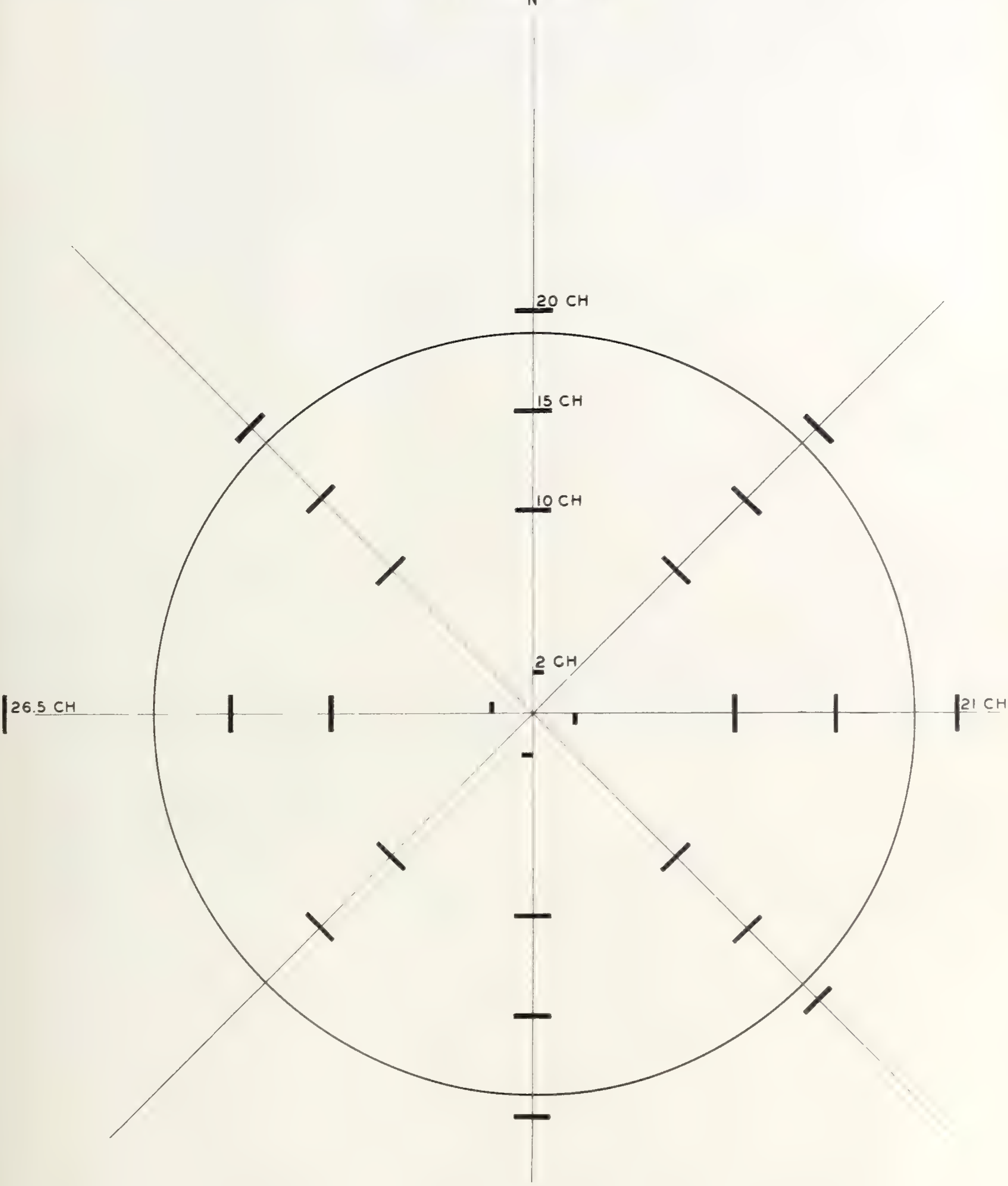
A second type of unit was planted at the 10, 15 and 20-chain points on each of the 8 radii except the southwest, west and east. Because of poor planting conditions at the 20-chain points on these three radii the unit for this point on the southwest was not planted, on the west was set at 27½ chains and on the east at 21 chains.

This second type of unit consists of a set of four blocks of pines, two on each side of the radius, planted along a line at right angles to the radius. The pines in each block were planted in 5 rows of 8 pines each spaced 5 links between both the pines and the rows. Each block is limited to one species of pine, the order from left to right (facing the circumference) being: (1) P. *lambertiana*, (2) P. *monticola*, (3) P. *flexilis* and (4) P. *strobus*. An interval of 10 links separates blocks 1 and 2 and blocks 3 and 4, but because of the older pines along each radius the interval between blocks 2 and 3 is 20 links.

As a check plot the balance of the transplants were planted in a unit along the Caribou Trail, southwest of Cheekye Lodge, 12 chains from the road. This unit consists of 32 P. *lambertiana*, 40 P. *monticola*, 19 P. *flexilis* and 25 P. *strobus*.

Diagrams No. 1 and 2, which follow, show the location of the pine susceptibility study units and the details of each type.

Diagram No. 1.



[illegible] B. [illegible]

SHOWING LOCATION OF SUSCEPTIBILITY

STUDY PLOTS PLANTED IN 1930

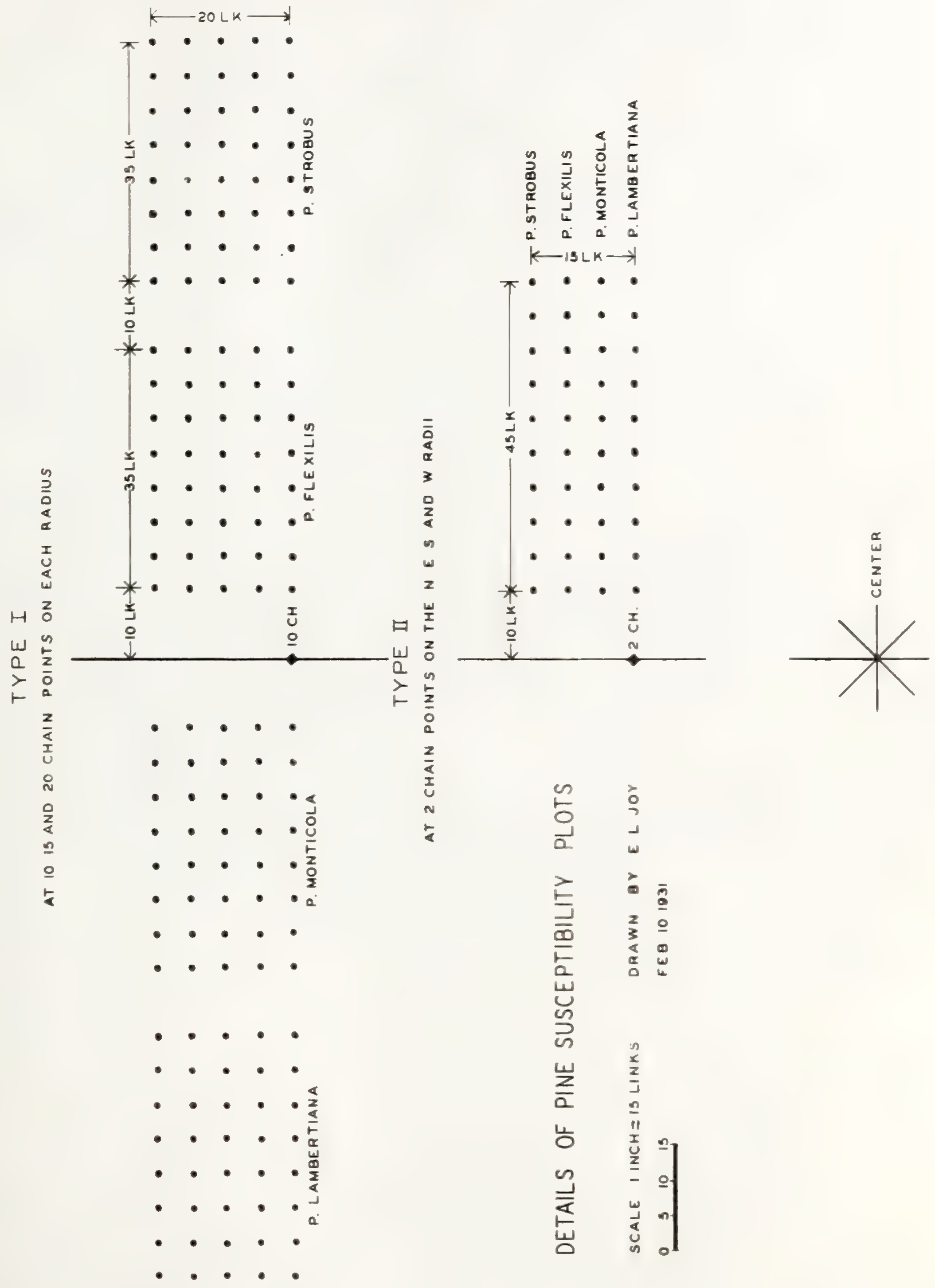
Drawn by E. L. Joy   February 5, 1931

SCALE 1 INCH = 4 CHAINS

0 1 2 3 4

Annual Report 1930
E. L. Joy

Diagram No. 2.



Annual Report 1930
E L Joy

B. Ribes Survey Around the Plot

A survey of the Ribes growing on a 2-chain wide strip adjacent to the circumference but outside the plot and on both sides of the extension of each radius was made. This survey was to determine the quantity of Ribes and their locations on this strip in an effort to correlate the amount of Ribes and the amount of infection on the pines in zones adjacent to these Ribes.

It is evident from the survey results that the Ribes growing on the 2-chain strip adjacent to the circumference of the plot and the radii extensions are not causing all or even the largest part of the infection. The results are too irregular and inconsistent to give any reasonable comparisons.

C. Eradication of Ribes from the Plot

Since the plot was not examined for Ribes in 1929, this work was done in 1930. A crew of men spaced about 1 rod apart covered the area by strips eradicating the Ribes bushes found within the circumference. Ribes were found at only two locations, one a R. lacustre 18 feet from the circumference on the west, and the other a group of R. sanguineum seedlings 80 feet from the circumference on the north.

D. Examination of the Planted Pines

1. Pine infection. The planted pines along the 8 radii and extensions were examined and data recorded as in previous years. These data are presented, as in 1928 and 1929, in Table No. 1 which shows the amount of infection in each of three zones which are: (1) the zone outside the circumference where the Ribes were not eradicated, (2) the protection zone or that strip 920 feet wide within the circumference, and (3) the area protected which is a circular area at the center having a 330-ft. radius.

TABLE NO. 1

INFECTION OF THE PLANTED PINES ON THE CHEENEY PLOT, 1930

Radius	Per Cent Pines Infected: Outside Plot	Protection Zone (920-Ft. Wide)	Area Protected Inner Circle (330-Ft. Radius)	Total
North	23.20	19.79	18.87	20.26
Northeast	12.83	10.23	9.57	11.04
East	8.97	17.94	22.92	17.41
Southeast	10.34	14.01	16.16	13.21
South	0.00	10.04	7.60	7.79
Southwest	13.04	13.57	8.60	12.45
West	10.17	18.18	20.00	17.41
Northwest	16.67	21.65	15.21	18.54
All Radii	14.85	15.72	14.01	15.12

An examination of Table No. 1 brings out quite definitely the fact that no appreciable protection from blister rust has been afforded the pines on the plot by the eradication of the Ribes therefrom.

A comparison of the 1930 results with those of 1929, 1928 and 1927 shows a decided increase in the amount of infection both on and off the plot. This is displayed in Table No. 2 which follows:

TABLE NO. 2

COMPARISON OF PINE INFECTION ON THE CHEENEY PLOT BY ZONES, 1927-1930

Year Examined	Per Cent Pines Infected: Outside Plot	Protection Zone (920-Ft. in Width)	Area Protected (Inner Circle With 330-Ft. Radius)	Total
1927	1.3	1.1	1.4	1.3
1928	5.5	6.4	5.1	5.9
1929	8.5	8.2	7.3	8.1
1930	14.9	15.7	14.0	15.1
Increase, 1927-1928	4.2	5.3	3.7	4.7
Increase, 1928-1929	3.0	1.8	2.2	2.2
Increase, 1929-1930	6.4	7.5	6.7	7.0
Increase, 1927-1930	13.6	14.6	12.6	13.8

[illegible] amount of infection [illegible] each of four [illegible] within area (1) the zone outside the circumference [illegible] were not eradicated, (2) the [illegible]

Contrary to the 1929 results the greatest increase in 1930 was found within the circumference of the plot but in no case is there any great difference in the amount of infection per zone. This, coupled with the fact that the largest amount of infection was found on the north, northwest and west radii indicates that it is very probable that the source of pine-infecting spores is a large quantity of Ribes north to northwest of the plot. Scouting in this direction revealed the information that R. <u>bracteosum</u>, R. <u>sanguineum</u> and R. <u>lacustre</u> are moderately abundant along the Cheakamus River to its mouth and thence along the Squamish River and in the wide alluvial flat adjacent to these rivers. No Ribes were found on the burned-over area between the plot and the river flat. The near edge of the flat is three-quarters and the rivers are one mile northwest of the center of the plot.

If the major source of the sporidia is three-quarters of a mile to one mile from the center of the plot, wind must be a very important factor in the transportation of these spores. It is very probable that the winds blowing in a southerly direction down the wide Squamish Valley fan out in a southeasterly direction at the mouth of the Cheakamus River and carry large quantities of spores to the plot across the open, burned-over area intervening. If this is the case, it is probable that eradication of all the Ribes for at least one mile from the circumference of the Cheekye plot would be necessary before the pines on the plot would be protected.

2. <u>Death of pines from blister rust</u>. As early as 1928 it was observed that a few of the infected pines had been killed by blister rust. In 1929, 3½ years after the pines were planted, this kill amounted to 12.8 per cent of the infected pines or one per cent of the total number of pines examined.

Analysis of the 1930 data shows 16.2 per cent of the infected pines killed by the disease, an increase of 3.4 per cent over the figures for 1929. This amounts to 2.3 per cent of the total number of pines examined or an increase over 1929 of 1.3 per cent.

3. <u>Normal survival of planted pines</u>. In the fall of 1930 the surviving pines totaled 81.49 per cent of the number planted 4 years before in the spring of 1926. Of the 18.51 per cent mortality in these 4 years, 14.42 per cent occurred the first year and 16.76 per cent the first two years.

CONCLUSION

In 1928 it was determined that a 1,250-ft. strip was not sufficient for the protection of white pine from blister rust under the conditions existing at Cheekye. In 1930, a survey of the Ribes conditions in the vicinity of the plot revealed the fact that the major source of pine-infecting spores is probably along the Cheakamus and Squamish Rivers 3/4ths to 1 mile northwest of the plot center. Thus, it is probable that at least a one-mile-wide protection zone would be needed at Cheekye and in comparable regions before the pines would be protected.

CONCLUSION

In 1918 it was determined that a 1,000-ft. strip was not sufficient for the protection of white pine from blister rust under the conditions existing at Cheney. In 1921, a survey of the Ribes conditions in the vicinity of the plot revealed the fact that the major source of pine-infecting spores lay probably along the limestone and [illegible] Ribes in 1 mile northeast of the plot [illegible]. Thus, it is probable that at least a one-mile-wide protection zone would be needed at Cheney and in comparable regions before the pines could be protected.

PROGRESS REPORT ON STUDIES OF THE RELATIVE SUSCEPTIBILITY OF PINUS MONTICOLA AND P. STROBUS GROWING UNDER WESTERN CONDITIONS - 1930

By
E. L. Joy,
Junior Forester

INTRODUCTION

In the spring of 1928 two plots were established in western Washington on which both *Pinus monticola* and *P. strobus* were growing. On the Pysht plot the pines are in three rows having grown from seed planted in 1916 by Mr. Merrill of the Merrill Ring Lumber Company. The Buck Creek plot is in a 1910 Forest Service planting area which was partially burned over in 1914. Both plots are in regions of abundant moisture.

PURPOSE

The two plots were established for the purpose of determining the relative susceptibility to blister rust of *P. monticola* and *P. strobus* when growing under western conditions.

WORK DONE AND RESULTS OBTAINED

In 1930 complete data were taken on all cankers found at Pysht. However, owing to the enormous increase in number of cankers and the limited time available it was only possible at Buck Creek to take the data on previously recorded cankers and to classify others on the basis of year of growth infected and stage of canker development.

The relative susceptibility of the two species of pine as determined from the 1930 data is indicated in Table No. 1. This table shows that the number of cankers per infected tree for *P. strobus* on the Pysht plot is greater than that for *P. monticola*, indicating a higher relative susceptibility for *P. strobus* than for *P. monticola*. Because only 5 *P. strobus* trees, the number on the plot, are used for this study and one of these had 151 of the 196 cankers found, it is apparent that the "number of cankers per infected tree" basis of comparison is not accurate.

Of unusual interest is the *P. strobus* tree with 151 cankers. In 1928 it had 4 cankers and in 1929 only 35. Subjected as it is to the same source of sporidia as the other trees on the plot, it is evident that this tree is more susceptible to blister rust than the average *P. strobus*.

TABLE NO. 1

COMPARISON OF THE AMOUNT OF INFECTION ON P. MONTICOLA AND P. STROBUS, BUCK CREEK AND FYGHT PLOTS - 1930

Plot	Pine Species	No. of Trees Examined	No. of Trees Infected	Per Cent Trees Infected	No. Cankers Per Infected Tree	No. Cankers Per Average Tree	Number Cankers Per M F.N.S.
Buck Creek	P. monticola	70*	62	88.6	80.8	71.6	141.0
	P. strobus	4**	3	75.0	5.3	4.0	6.5
Fyght	P. monticola	74	70	94.6	26.9	25.4	71.0
	P. strobus	5	5	100.0	39.2	39.2	15.7
Combined Plots	P. monticola	144	132	91.7	52.2	47.9	111.1
	P. strobus	9	8	88.9	26.5	23.6	14.2

*Originally 72. 1 destroyed, 1 too large to inspect.
**Originally 5. 1 destroyed.

Using one thousand feet of needle stem as the basis for comparison, the results from a combination of the trees of both plots indicate that in the West *P. monticola* is 7.8 times as susceptible as *P. strobus*. In 1928 this rate was determined as 8.9 and in 1929 as 5.7. The data obtained in 1930 include practically all the cankers formed from the probable year of origin, 1926, to and including those formed in 1927 and many of those started in 1928. Therefore, the 1930 results indicate the relative susceptibility of the two species after approximately the first five years of subjection to the disease.

CONCLUSION

In order to determine the actual relative susceptibility of these two species, additional susceptibility determinations must be made from data taken annually. When these determinations approach a constant figure the actual relative susceptibility of *P. monticola* and *P. strobus* under western conditions will have been determined.

TABLE NO. 1

COMPARISON OF THE RELATIVE SUSCEPTIBILITY OF P. MONTICOLA AND P. STROBUS, DUNN CREEK AND PYATT PLOTS – 1940

Plot	Pine species	No. of Trees: Inoculated	No. of Trees: Infected	Per Cent Trees Infected	No. Cankers Per: Infected Tree	No. Cankers Per: Average Tree	Number Cankers Per M l.f.s.
Dunn Creek	P. monticola	70*	[illegible]	[illegible]	[illegible]	[illegible]	141.0
	P. strobus	4**	3	75.0	[illegible]	[illegible]	6.5
Pyatt	P. monticola	74	[illegible]	[illegible]	[illegible]	[illegible]	71.0
	P. strobus	5	[illegible]	100.0	[illegible]	[illegible]	15.7
Combined Plots	P. monticola	144	132	91.7	[illegible]	[illegible]	111.1
	P. strobus	9	8	88.9	[illegible]	[illegible]	14.2

*Originally 72. 1 destroyed, 1 too large to inspect.

**Originally 5. 1 destroyed.

Using one thousand feet of needle stem as the basis for comparison, the results from a combination of the trees of both plots indicate that in the East P. monticola is 7.8 times as susceptible as P. strobus. In 1938 this rate was determined as 3.8 and in 1939 as 4.7. The data obtained in 1940 include practically all the cankers formed from the probable year of origin, 1935, to and including those formed in 1937 and many of those started in 1938. Therefore, the 1940 results indicate the relative susceptibility of the two species after approximately the first five years of subjection to the disease.

CONCLUSION

In order to determine the actual relative susceptibility of these two species, additional susceptibility determinations must be made from data taken annually. When these determinations approach a constant figure the actual relative susceptibility of P. monticola and P. strobus under eastern conditions will have been determined.

PROGRESS REPORT ON NEWMAN LAKE INFECTION STUDY, NEWMAN LAKE, WASHINGTON

1930.

By

E. E. Myers

Agent

PURPOSE

The purpose of Newman Lake infection plot is to study the effect of Ribes lacustre as a factor in the intensification and spread of white pine blister rust where the disease is well established.

LOCATION

The plot is located 26 miles northeast of Spokane, Washington in townships 26 and 27 north, range 5 east, sections, 4, 5, 32 and 33.

WORK DONE PREVIOUS TO 1930

White pine blister rust was found on this area May 10, 1928. Thorough scouting of the general region was done that same year. No other infected areas were found in the vicinity of Newman Lake.

Necessary surveys and maps were made of the area selected for the study during the late autumn of 1928. During the spring of 1929 the area was subdivided into 1-chain-square blocks. Eradication of R. inerme was done in two operations, one on May 6 to 8, 1929 and the second two weeks later. Infection data and locations of all white pines and R. lacustre on the plot were recorded during the period May 10 to August 23, 1929. All R. inerme bushes found during this period were eradicated.

WORK DONE 1930

The plot was again gone over for R. inerme on May 6 and 7, 1930, and all bushes found were destroyed. In the course of work on the plot during the summer missed R. inerme bushes found were eradicated.

The plot boundaries were extended east and south to include 10.8 acres additional area increasing the size of the plot to 36.2 acres. Data were recorded on pines and R. lacustre on the entire 36.2 acres.

Relative humidity readings taken with a sling psychrometer were recorded three or four times per day during the summer season.

A. Removal of R. inerme

In each of the successive eradications of R. inerme from the

PROGRESS REPORT ON WARMAN LAKE INFECTION STUDY, PRIEST LAKE, WASHINGTON
1930

By

A. [illegible] Byers

Agent

PURPOSE

The purpose of Warman Lake infection plot is to study the effect of *Ribes lacustre* as a factor in the intensification and spread of white pine blister rust where the disease is well established.

LOCATION

The plot is located 25 miles northeast of Spokane, Washington in township 29 and 30 north, range 2 east, sections 4, 5, 32 and 33.

WORK DONE PREVIOUS TO 1930

White pine blister rust was found on this area May 10, 1926. Thorough scouting of the general region was done that same year. No other infected areas were found in the vicinity of Warman Lake.

Preliminary surveys and maps were made of the area selected for this study during the late season of 1926. During the spring of 1927 the area was subdivided into 1-chain-square blocks. Eradication of *R. lacustre* was done in two operations, one on May 5 to 6, 1927 and the second two weeks later. Infection data and locations of all white pines and *R. lacustre* on the plot were recorded during the period May 12 to August 25, 1927. All *R. lacustre* bushes found during this period were eradicated.

WORK DONE 1930

The plot was again gone over for *R. lacustre* on May 6 and 7, 1930, and all bushes found were destroyed. In the course of work on the plot during the summer missed *R. lacustre* bushes found were eradicated.

The plot boundaries were extended east and south to include 10.9 acres additional area increasing the size of the plot to 26.2 acres. Data were recorded on pines and *R. lacustre* on the entire 26.2 acres.

Relative humidity readings taken with a sling psychrometer were recorded three or four times per day during the summer season.

A. Removal of R. lacustre

In each of the successive eradications of *R. lacustre* from the

plot there has been a very definite and material reduction in feet of live stem per acre. The first time over in May 1929 there were removed 3,698 feet of live stem of R. inerme per acre. In the final and fifth time over during the summer season of 1930 R. inerme bushes were found and removed at the rate of only 3 feet of live stem per acre. This unusually high success in removing R. inerme by hand eradication is probably due chiefly to two factors; (1) the personnel employed consisted of the permanent members of the office, leaders in eradication and allied projects, and (2) the work was done early in the season when R. inerme was leaved out and plainly visible against the still unleaved branches of associated brush.

Careful observations of all R. inerme eradicated since 1929 have been made and no trace of infection has been found. The major portion of the eradication work has been done in the spring before time for infection to show on the Ribes leaves.

B. Ribes lacustre Information

In Table No. 1 is shown a comparison of the amounts of R. lacustre present on the plot in 1929 and 1930.

TABLE NO. 1

AMOUNT OF R. LACUSTRE ON HERMAN LAKE INFECTION PLOT - 1929 AND 1930

Year	Number of Acres	Totals on Plot: Bushes	F.L.S.	Leaves	Absolute* Area in Square Feet	Per Acre: Bushes	F.L.S.	Average F.L.S. Per Bush
1929	25.4	559	53,791	1,233,333	2,719	22	2,113	96
1930	36.2	592	20,008	560,614	1,356	16	553	35

*By "absolute area" is meant the theoretical area on the ground taken up by the Ribes bushes if they were concentrated to a 100 per cent density. It is the product of the actual ground area of a bush and its estimated density in tenths.

An examination of Table No. 1 discloses the fact that apparently there was a very large reduction in the amount of R. lacustre in 1930 over what it was in 1929. An examination of the original data sheets showed that there were appreciable amounts of dead stem in 1930 that were alive in 1929. There were 12 R. lacustre bushes completely dead in 1930 which were alive in 1929.

This heavy shrinking in amount of R. lacustre in 1930 from what it was in 1929 was apparently due in large measure to the dry conditions in 1929. The human element of estimation of live stem was undoubtedly a factor. However, the same man worked on the plot and took the data in both years, and his errors should be largely compensating.

In Table No. 2 there is shown the amount of R. lacustre infection in 1929 and 1930.

TABLE NO. 2

COMPARATIVE AMOUNTS OF INFECTION ON R. LACUSTRE 1929 AND 1930, HERMAN LAKE INFECTION PLOT

Year	Number of Fruiting Cankers	Number of Bushes Infected	Per Cent of Bushes Infected	Number of Infected Leaves	Equivalent Number of Leaves* 100 Per Cent Infected			
					Uredinia	Telia	Necrotic Areas	Total Infection
1929	27	6	1.1	77	0.07	0.02	0.76	0.85
1930	257	62	10.7	979	20.00	31.00	7.00	58.00

*By the term "Equivalent number of leaves 100 per cent infected" is meant the number of leaves 100 per cent infected if all the infected leaf surfaces were concentrated.

It is apparent in Table No. 2 that there was a large increase in the amount of R. lacustre infection in 1930 over what it was in 1929, particularly in the production of telia.

The numbers of fruiting cankers are shown in the Ribes infection table because they constitute a rough measure of the amount of aecia to which the Ribes were exposed.

In order to obtain a better picture of the amount of Ribes infection on the plot in 1929 and 1930 the data in Table No. 2 are shown in Table No. 3, as ratios of 1929 values to those of 1930.

[illegible]

[illegible]

there was a very large reduction in the amount of R. [illegible] in 1930 over what it was in 1929. An examination of the original notes [illegible] that there were appreciable amounts of leaf [illegible] little infection. There were [illegible] R. [illegible] bushes completely [illegible] in 1930 [illegible] were alive in 1929.

TABLE NO. 3

RATIOS OF DIFFERENT EXPRESSIONS OF R. LACUSTRE INFECTION IN 1929 TO THOSE IN 1930 NEWMAN LAKE INFECTION PLOT

Class of Data	Ratios	
	1929	1930
Number of cankers producing aecia	1	9.5
Number of infected R. lacustre bushes	1	10.3
Number of infected R. lacustre leaves, total	1	12.7
Equivalent number of leaves 100 per cent infected - uredinia	1	286.7
Equivalent number of leaves 100 per cent infected - telia	1	1,550.0
Equivalent number of leaves 100 per cent infected - necrotic areas	1	9.2
Equivalent number of leaves 100 per cent infected - all stages	1	68.2

The information in Table No. 3 is most interesting. It may be observed that the ratio of values in 1929 to 1930 is quite similar in the cases of fruiting cankers, infected bushes, and infected leaves. In other words, apparently in this instance, the number of bushes infected and number of leaves infected seem quite dependent upon the amount of aecia present. However, when the infection per infected leaf, represented as the equivalent number of leaves 100 per cent infected is considered, this ratio is very largely ignored, and the 1930 portion of the ratio greatly increased. This situation would mean that there was much greater activity of the rust within the leaf tissues in 1930 than in 1929. In other words, it seems that the number of bushes and leaves infected is dependent upon the aecial source but that the amount of infection per infected leaf and the type of infection were more dependent upon some other factor or factors, possibly environmental in nature.

It is well known that conditions of high relative humidity favor rust activity. Moisture conditions were generally more favorable for rust development in the Inland Empire in 1930 than in 1929. In a publication prepared by the Spokane office of the Weather Bureau entitled: "A Summary of Fire Weather Records for the Season of 1930", Francis G. Crombie states (page 1, paragraph 2): "Precipitation * * * was especially kind to this district this past season. * * * The real significance of this season's precipitation will be found to be its distribution in point of time. The decade precipitation being of such amounts and so nicely timed that the forests were kept in a comparatively safe condition throughout the season".

Mr. Crombie goes on to say in the same publication (page 3, paragraph 1), "This season's higher relative humidity combined with even distribution, in point of time, of the precipitation, very probably was responsible for the mitigated fire danger throughout the season.

" There were, on an average, fewer days with the relative humidity down to the danger point this season (1930) than last (1929) * * * the actual number of hours (of very low relative humidity) * * * was likewise found to be considerably less this year (1930) than last (1929)".

It seems probable that the much greater activity of the rust in the Ribes leaf in 1930 over what it was in 1929 is closely related to the greater amount of moisture in 1930.

Whether or not the relative humidity at the Newman Lake plot was higher in 1930 than in 1929 is not known. However, it is known that the relative humidity at Newman Lake in 1930 was decidedly higher than that at Spokane on the same days and hours. Throughout the summer season of 1930 sling psychrometer readings of relative humidities were taken on the plot, usually at 9 a.m., 12 noon, and 4 p.m. Readings from a hygrothermograph at Spokane were taken on the same days and hours. The averages for these readings are as follows:

Mean relative humidity, Newman Lake = 47 per cent.
Mean relative humidity, Spokane = 33 per cent.

Thus there was a difference of 14 per cent relative humidity in favor of Newman Lake.

C. General Pine Conditions, 1930

Analysis of the basic data on the white pine population showed that 52 pines which were alive in 1929 were dead in 1930. In an analysis of the causes of death it was seen that for pines 1-10 years old chewing by rabbits was the greatest single cause of death. Among the trees 11 years and older suppression was by far the largest single factor causing death. 44 of the 52 dead pines were in the suppressed crown class.

In order to obtain some indication of how constant a factor needle retention habit is, data on the number of years needles are born were compiled for the same trees in 1929 and 1930. The results of this study showed that there was little change in the needle-retaining habit of the trees in the two years. In both years the trees 11 years and older tended to hold their needles longest in the intermediate and suppressed crown classes.

D. Pine Infection

All pine infection on the plot found thus far is chargeable to *R. lacustre* present and *R. inerme* removed during 1929 and 1930. It will be 1931 or 1932 before the sole effect of the *R. lacustre* in causing pine infection will be evident.

TABLE NO. 4

GENERAL INFORMATION ON PINE INFECTION, [illegible] LAKE INFECTION PLOT, 1930

Item	1929	1930
Acres worked	25.4	36.2
Total number of pines examined	752.0	1,328.0
Total number of pines infected	68.0	113.0
Per cent of pines infected	9.0	8.5
Total number of cankers found	*555.0	1,535.0 *
Average number of cankers per infected tree	8.2	13.6
Average number of cankers per thousand feet needle-bearing stem	8.4	16.0
Per cent of total needle-bearing stem borne by infected trees	35.7	33.9
Feet needle stem per average tree on plot	88.2	72.3
Feet needle stem per average infected tree	343.7	283.5
Feet needle stem per average non-infected tree	62.3	52.2

*These totals include 21 cankers found and destroyed in May, 1930.

An examination of Table No. 4 reveals several interesting points:

1. Although there were 45 more pines found infected in 1930 than in 1929, there resulted a lower per cent of pines infected in 1930 than in 1929. The reason for this apparent contradiction lies in the fact that the pines on the 10.8-acre extension of the plot were so much less heavily infected than those on the old portion of the plot that the grand average was reduced. Had a comparison been made of the per cent of the same pines infected in 1929 and 1930, the infection in 1930 would undoubtedly have been much higher.

2. That intensification of pine infection occurred is shown by the fact that there were nearly 3 times as many cankers found in 1930 as in 1929, that the cankers per infected tree were more numerous, and that there were twice as many cankers per thousand feet of needle stem in 1930 as in 1929.

3. The per cent of needle-bearing stem borne by infected trees, 35.7 per cent in 1929, 33.9 per cent in 1930, is roughly 4 times the per cent of pines infected.

4. In both 1929 and 1930 it may be observed that the average infected pine had roughly 4 times as much needle stem as the average pine on the plot, and nearly 6 times as much as the average non-infected pine.

Pine infection found in 1929 and 1930 was studied in relation to crown class. By far the greatest amount of pine infection in both years occurred on trees 11 years old and older in the dominant crown class. Dominant trees are usually in the open exposed to blister rust and they have the largest amount of needle stem exposed. In Table No. 4 it may be seen that the amount of needle stem on infected trees was roughly 6 times that borne by non-infected trees. It is unfortunate that blister rust attacks most severely the best trees in a stand.

E. Analysis of Cankers.

All cankers found in 1930 were classified according to the year of growth infected and stage of canker development.

In addition to the cankers found in 1930 there were found and destroyed 21 cankers in May, 1928. An analysis of these 21 cankers quite plainly indicated that infection on the Newman Lake plot originated in 1923.

An analysis of the 1,514 cankers found in 1930 showed that comparative large numbers of cankers were formed in 1927 and 1928. Owing to the fact that the early cankers of 1928 origin appeared at the same time as retarded cankers of 1927 origin the numbers formed in each year could not accurately be segregated.

Of the 1,514 cankers found in 1930, 76 were dead. Their arrangement according to year of growth infected showed that very probably many of them were of 1927 origin and had never produced aecia. Most of these dead cankers occurred on small twigs which were easily killed.

SUMMARY

1. Although the increase in the number of Ribes bushes infected in 1930 over 1929 was roughly comparable to the increase in number of fruiting cankers, the increase in infected leaf surface, especially in

telial production, was very much greater in 1930 than in 1929. In general, higher relative humidity conditions obtained in 1930 than in 1929, possibly accounting in part for the much greater Ribes infection in 1930.

2. Intensification of the rust on pines was more evident in 1930 than in 1929, in that in 1930 there were nearly twice as many trees infected and three times as many cankers present as in 1929.

3. The pine infection on the Newman Lake infection plot is chargeable to R. inerme removed in 1929 and R. lacustre which remains. Sufficient time has not yet elapsed to measure in pine infection terms the effect of R. lacustre alone. The effect of the removal of R. inerme will begin to be noticeable in the spring of 1931.

telial production, was very much greater in 1929 than in 1929. In general, higher relative humidity conditions obtained in 1930 than in 1929, possibly accounting in part for the much greater [illegible] infection in 1930.

2. Intensification of the rust on plants was more evident in 1930 than in 1929, in that in 1930 there were nearly twice as many leaves infected and three times as many cankers present as in 1929.

3. The [illegible] infection on the [illegible] infection plots is comparable to B. [illegible] removed in 1929 and L. [illegible] [illegible] [illegible]. Sufficient time has not yet elapsed to measure in this infection area the effect of B. [illegible] alone. The effect of the removal of L. [illegible] will begin to be noticeable in the spring of 1931.

SPREAD OF THE RUST STUDY, CHICO, WASH., 1930

E. L. Joy
Junior Forester

INTRODUCTION

In 1926 a pine infection center was located about 7 miles northwest of Bremerton at Chico, Kitsap County, Washington. It was learned that a patch of infected *Ribes nigrum* bushes had been removed from a nearby farm in 1922. Scattered *R. sanguineum*, *R. lacustre* and *R. divaricatum* were found in this vicinity. Examination of this infection in 1926 and the analysis of cankers found in 1930 indicate the year of origin of this infection to be 1919 or earlier.

Scouting done in this vicinity in 1930 revealed the fact that very few native Ribes are now growing near the original infection center and consequently very few cankers of recent origin were found. The discovery in the stand of one *R. sanguineum* bush having 20 feet of live stem and an abundance of young cankers on only the adjacent trees suggested a study of the ability of this one bush to intensify and spread the disease. This study, which was made in October, 1930, was conducted to determine the amount of new infection on the pines in concentric zones of equal width around the one Ribes bush found.

WORK DONE

With the Ribes bush as the center, a block consisting of 4-square chains was surveyed. String was used to mark the boundaries of each square chain. The pine locations were then plotted and numbered on map sheets, using the scale 5 inches equals one chain, each square chain being divided for more accurate mapping, into 100 milacre squares.

After the plotting and numbering of a pine, data were taken on the age, height, feet of needle-bearing stem, crown class and amount of infection for this tree. The amount of infection was determined from the canker analysis made for each tree, which consists of a classification of each canker according to its stage or degree of development and the year of the growth on which it occurs.

From the field data, compilations were made of the amount of infection in each successive 1/10-chain wide circular zone around the Ribes bush. In order to evaluate the infecting ability of this bush the canker data of the trees in each zone were segregated into two classifi--

cations, which are: (1) the cankers on growth developed in 1922 or earlier, and (2) those on growth made since 1922. This division was made because in 1922 the R. nigrum bushes, probably responsible for introducing the rust into this region, were destroyed. Further classifications were made to show the number of cankers formed since 1922 per average tree, and per thousand feet of needle-bearing stem.

RESULTS

Compilations made to show the infection conditions on each successive 1/10-chain wide circular zone around the Ribes bush are shown in Table No. 1.

Although there is a fairly consistent degression in the per cent of trees infected per zone outward from the Ribes bush, this same condition is not obtained by a zone segregation of the cankers formed on 1922 and older growth. Where comparison was made of the cankers in each zone on growth developed since 1922, the percentages do show a consistent degression for the first eight zones or for a distance of 0.8 chain from the Ribes bush. The results for the next two zones show a decided increase in the per cent of cankers on the growth made since 1922. Explanation of this probably lies in the fact that a much larger number of pines fell in these two zones, most of which were in a dense stand of young timber on the moist, north-facing slope. Conditions there are, no doubt, more conducive to the innoculation of the pines.

The results from prorating the cankers on wood produced since 1922 according to the total number of trees in each zone and the number of thousand of feet of needle-bearing stem per zone are the most encouraging but still are very irregular. It is apparent that neither of these methods have resulted in the degression desired.

cations, which are: (1) the cankers on growth developed in 1921 or earlier, and (2) those on growth made since 1921. This division was made because in 1922 the R. alpinum bushes, probably responsible for introducing the rust into this region, were destroyed. Further classifications were made to show the number of cankers formed since 1921 per average tree, and per thousand feet of needle-bearing stem.

RESULTS

Compilations made to show the infection conditions on each successive 1/10-chain wide circular zone around the Ribes bush are shown in Table No. 1.

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The results from prorating the cankers on wood produced since 1921 according to the total number of trees in each zone and the number of thousand of feet of needle-bearing stem per zone are somewhat encouraging but still are very irregular. It is apparent that neither of these methods have resulted in the degression desired.

TABLE NO. 1

ANALYSIS OF INFECTION CONDITIONS BY ZONES AROUND ONE RIBES SANGUINEUM BUSH, CHICO, WASHINGTON, 1930

1/10th Chain Wide Zone Number	Pine Data				Canker Data				
	No. Exam.	Feet Needle Stem	% of Trees Infected	% Infected Since 1922	Total Number Found	% on 1922 or Older Growth	% on Growth Since 1922	Number Since 1922 Per Ave. Tree	Number Since 1922 Per M.*F.N.S.
1	5	853	80.0	60.0	69	8.7	91.3	12.6	73.9
2	9	2,739	88.9	77.8	46	8.7	91.3	4.7	15.3
3	6	1,815	83.3	50.0	12	8.3	91.7	1.8	6.1
4	16	6,910	68.8	56.2	131	9.9	90.1	7.4	17.1
5	13	3,260	46.2	38.4	65	10.8	89.2	4.5	17.8
6	21	8,895	47.6	47.6	32	18.7	81.3	1.2	3.9
7	10	10,225	50.0	30.0	17	52.9	47.1	0.8	0.8
8	23	12,471	34.8	17.4	25	60.0	40.0	0.4	0.8
9	40	16,136	30.0	22.5	20	55.0	45.0	0.2	0.6
10	33	18,485	27.3	24.2	29	24.1	75.9	0.7	1.2
Totals or Ave.	176	81,789	44.3	34.7	446	17.7	82.3	2.1	4.5

*Feet needle stem.

CONCLUSIONS

Because of the fragility of the sporidia, which is the explanation of their short period of effectiveness, any single Ribes bush in a stand of white pine is limited in its ability as a disease spreading host. The maximum distance the disease can be spread from native Ribes under natural conditions probably varies from a few feet to one mile or more, depending on the various existing factors such as the location and condition of the host, status of the disease, weather, topography, and the association of other plant life. Therefore there should be a fairly regular degression away from the Ribes in the amount of pine infection caused by one bush.

Results obtained from the Chico study do show in each method of comparison, a decrease in the amount of infection, in the first and last zones and in general a decrease outward from the bush. It is evident that the area studied and therefore the zones are not sufficiently large to give the necessary data for a fairly regular degression. Further study of this and of other suitable areas will give much valuable information on the disease spreading ability of native Ribes in white pine stands.

TABLE NO. 1

ANALYSIS OF INFECTION CONDITIONS BY ZONES ABOUT ONE RIBES BUSH
SITE, CHICO, WASHINGTON, 1930

1/10th Chain Wide Zone Number	Pine Data				Canker Data				
	No. Exam.	Feet Needle Stem	% of Trees Infected	% Infected Since 1922	Total Number Fungi	% on 1922 or Older Growth	% on Growth Since 1922	Number Since 1922 Per Ave. Tree	Number Since 1922 Per M.ft.B.M.
1	5	552	50.0	60.0	52	5.7	91.3	12.6	73.9
2	9	2,729	55.5	77.8	46	8.7	91.3	4.7	15.5
3	6	1,215	83.3	50.0	12	8.3	91.7	1.8	5.1
4	16	6,910	68.8	36.2	131	9.9	90.1	7.4	17.1
5	13	5,280	46.2	38.4	65	10.8	89.2	4.5	12.8
6	21	8,895	47.6	47.6	43	18.7	81.3	1.7	2.9
7	10	10,325	50.0	30.0	17	52.9	47.1	0.9	0.3
8	23	12,571	34.8	17.4	23	60.0	40.0	0.4	3.3
9	40	26,136	30.0	12.5	20	75.0	25.0	0.2	0.6
10	33	16,483	27.3	24.2	23	24.1	75.9	0.7	1.8
Totals or Ave.	176	81,777	44.3	34.7	446	17.7	82.3	2.1	4.1

*Feet needle stem.

CONCLUSIONS

Because of the fragility of the sporidia, which is the explanation of their short period of effectiveness, any single Ribes bush in a stand of white pine is limited in its ability as a disease spreading host. The maximum distance the disease can be spread from native Ribes under natural conditions probably varies from a few feet to one mile or more, depending on the various existing factors such as the location and condition of the host, status of the disease, weather, topography, and the association of other plant life. Therefore there should be a fairly regular degression away from the Ribes in the amount of pine infection caused by one bush.

Results obtained from the Chico study do show in each method of comparison, a decrease in the amount of infection, in the first and last zones and in general a decrease outward from the bush. It is evident that the area studied and therefore the zones are not sufficiently large to give the necessary data for a fairly regular degression. Further study of this and of other suitable areas will give much valuable information on the disease spreading ability of native Ribes in white pine stands.

The white ribbon is the Potlatch Lumber Company's railroad, constructed during and after the disease survey was made. Just below the railroad may be seen Three Bear Creek flowing from the left and Long Meadow Creek flowing from the right. The junction of the two creeks may be seen at the lower right center. The infected area is outlined in brown. The three solid brown triangles represent the approximate locations of the centers originating in 1923.

BLISTER RUST INFECTION SURVEYS IN IDAHO, 1930

By
H. N. Putnam,
Associate Pathologist

INTRODUCTION

In the fall of 1930 the first blister rust infection survey was made in the West at Rhododendron, Oregon, a description of which is in the 1929 annual report. This proved to be such a good method of obtaining an impartial and quantitative expression of infection that the same procedure was followed in 1930 in studying well established infections in Idaho.

Without some sort of a quantitative basis it is quite impossible to make an accurate evaluation of an infection. By a haphazard examination of an infection, emphasis is apt to be placed at the center where the rust is heaviest. For this reason it is the human tendency to express the average infection in terms of its greatest severity. An impartial systematic survey, with strips at regular intervals results in a much more accurate statement of infection.

The uses of such an evaluation of infection are obvious. From it may be obtained an expression of the amount of pine infection chargeable to known amounts of known Ribes species. The rate of increase in cankers can be determined and made the basis for forecasting future development of the rust and the rate of damage to the pines. A disease survey is essential to the proper planning of a permanent infection study plot.

PURPOSE

As already implied in the introduction the purpose of making a blister rust infection survey is to obtain an accurate, impartial quantitative expression of the status of the disease and its hosts.

METHOD OF WORK

The method in brief consisted in taking essential data on strips 0.2 chain wide at regular intervals through the infected area. On the Long Meadow and Deep-Elk Creek areas a 4% cruise was made by locating strips at 5-chain intervals. On the St. Maries River and Merry Creek areas a 2% cruise was run by spacing the strips 10 chains apart.

On each strip data were taken by one chain long transects on topography, pines, Ribes and the infection on both hosts. Pine data included crown class, height, age, D.B.H. feet of needle stem, years needles

borne, and the number of cankers classified according to the year of growth infected and the canker stage. Data on Ribes included species, feet of live stem, degree of shading, and infection expressed as a per cent and differentiated as to uredinial, telial and necrotic infection.

LOCATION AND AMOUNT OF WORK DONE

In Table No. 1 there are shown the locations of infected areas studied and the number of strips run.

TABLE NO. 1

EXTENT OF DISEASE SURVEYS, IDAHO, 1930

Location of Infection Studied	Per Cent Cruise	Number Strips	Number Milacres
Long Meadow Creek, T. 39 N., R. 1 E. Sec. 14	4	16	2,760
Elk Creek, Deep Creek, T. 39 N., R. 2 E. Sec. 14	4	22	2,160
St. Maries River, near Clarkia, T. 42 N., R. 2 E., Sec. 5, 8-13	2	45	6,520
Merry Creek near Clarkia, T. 43 N., R. 2 E. Sec. 25	2	17	1,780

RESULTS

In Table No. 2 there are shown the general findings of the disease surveys made in 1930.

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TABLE NO. 1

EXTENT OF DISEASE SURVEYS, IDAHO, 1930

Location of Infection Studied	Per Cent Cruise	Number Strips	[illegible] Acres
Long Meadow Creek, T. 37 N., R. 1 E. Sec. 14	5	12	[illegible]
Elk Creek, Deep Creek, T. 38 N., R. 2 E. Sec. 18	4	22	1,160
St. Maries River, near Clarkia, T. 42 N., R. 2 E., Sec. 1, 6-12	[illegible]	[illegible]	[illegible]
Merry Creek near Clarkia, T. 42 N., R. 2 E. Sec. 33	2	17	[illegible]

RESULTS

In Table No. 2 there are shown the general findings of the disease surveys made in 1930.

TABLE NO. 2

GENERAL INFORMATION FROM DISEASE SURVEYS, 1930

Item	Long Meadow	Elk-Deep Creeks	St.Maries River	Merry Creek
Number of acres cruised	69.0	52.5	326	89
Approximate number of acres of infected area	47.6	50.0	264	11
Type in which infection occurred	Upland	Stream	Stream	Stream
Age class of pines	11-40	11-40	21-40	21-40
Number of pines per acre on infected area	754 (a)	336 (a)	84 (a)	177 (a)
Total number of pines on infected area (calculated)	35,890	16,800	22,176	1,947
Number of pines examined on infected area	1,862	612	403	33
Number of pines infected on infected area	338	162	46	6
Per cent of pines infected on infected area	18.1	26.5	11.3	18.2
Probable year of origin of infection	1923	1923	1923	1927
Number of cankers found probably formed in year of origin	11 (b)	3 (c)	1	?
Total number of cankers found	4,900	638	188	7
Per cent increase in numbers of cankers formed since year of origin	144,478	21,167	18,700	[illegible]
Calculated total number of cankers on infected area	120,000	16,950	9,400	[illegible]
Average number of cankers per thousand feet of needle-bearing stem	28.8	12.6	1.8	2.1
R. petiolare feet of live stem per acre	0.0	745.0	58,579.0	11,759.0
R. inerme feet of live stem per acre	0.0	0.0	17,167.0	50.0
R. irriguum feet of live stem per acre	0.0	1,197.0	0.0	0.0
R. viscosissimum feet of live stem per acre	278.0(d)	173.0	2.0	265.0
R. lacustre feet of live stem per acre	803.0(d)	882.0	9,537.0	291.0
Total Ribes feet of live stem per acre	1,081.0(d)	2,997.0	85,285.0	12,364.0

(a) The numbers of pines shown per acre are those on the infected area, stream type and timber type combined. The number of pines per acre in the timber type alone is much larger in each case.

(b) The 11 cankers of 1923 origin shown are based on a much higher per cent cruise of each infection center than for the infection as a whole.

(c) These 3 cankers of 1923 origin were found in the summer of 1929.

(d) The feet of live stem of Ribes as shown are those estimated to be on the area before eradication, and to which infection on the pines was chargeable. Eradication work in 1929 reduced these feet of live stem to 341 per acre in 1930.

Attention is called to certain points in Table No. 2.

1. The Long Meadow infection was the only one of the four which can properly be considered as chargeable chiefly to upland Ribes.

2. As judged by the per cent increase in numbers of cankers since the year of origin, and by the number of cankers per thousand feet of needle stem, it is apparent that infection was more severe at Long Meadow and at Elk-Deep Creeks, than at the other two infections. The per cent of pines infected does not show this same grading of infection centers with reference to severity, and in this case is obviously misleading.

3. On the Long Meadow area, the most severe infection known in Idaho, neither R. petiolare nor R. inerme were found. In both of the areas showing the least rust intensification, the St. Maries River, and Merry Creek areas, R. petiolare and R. inerme were both present, and the former Ribes species was abundant. There was an apparent negative correlation between Ribes species of high relative susceptibility and rust intensification on the pines.

4. That the abundance of Ribes alone was not the controlling factor in causing the intensification of pine infection may be observed. The severity of infection as measured by the cankers per thousand feet of needle stem is in inverse ratio to the amount of Ribes per acre. The area having the least quantity of Ribes per acre, the Long Meadow area, showed the largest number of cankers per thousand feet of needle stem. Conversely, the St. Maries River infection on which was found the smallest number of cankers per thousand feet of needle stem, showed by far the largest quantity of Ribes per acre.

5. The number of cankers per thousand feet of needle stem varied directly as the number of pines per acre on the infected areas. This fact is probably significant of the importance of the degree of association of pines and Ribes in intensifying the rust. The larger the number of pines per acre, the more closely is the association of Ribes and pines. In an upland type the distance between Ribes and pines is much less than in a well pronounced stream type. It has been pointed out that the greatest amount of intensification of the rust occurred at Long Meadow essentially an upland type infection.

No expression of Ribes infection is shown in Table No. 2. Only a small amount of Ribes infection was found in 1930. At Merry Creek no Ribes infection was found on the strips. At the other three places Ribes infection was very slight.

In Table No. 3 there are shown relative humidity per cents at the four points compared with these for the same hours and days at Moscow, Idaho.

TABLE NO. 3

COMPARISON OF AVERAGE DAYTIME RELATIVE HUMIDITY PER CENTS AT THE FOUR PINE INFECTION CENTERS WITH COINCIDENT RELATIVE HUMIDITY PER CENT READINGS AT BOVILL, IDAHO, 1930

Place	Period	Number of Readings	Average Relative Humidity Per Cent at Infection Center	Average Relative Humidity Per Cent at Bovill Taken at Same Time	Increase in Relative Humidity Per Cent Over That at Bovill, Idaho
Long Meadow	Jul.1 to Jul. 17	17	59	31	+28
Elk-Deep Creeks	Aug.6 to Aug. 13	14	71	37	+34
St. Maries River	Jul.26 to Jul.29	7	59	33	+26
Merry Creek	June 29 to Aug. 16	42	68	40	+28

The determination of the relative humidity per cents at the four infection centers was based on sling psychrometer readings taken at different times in the summer. As a basis of comparison, relative humidity per cent readings were taken from the records of the hygrothermograph at Bovill, the instrument nearest to all four infections.

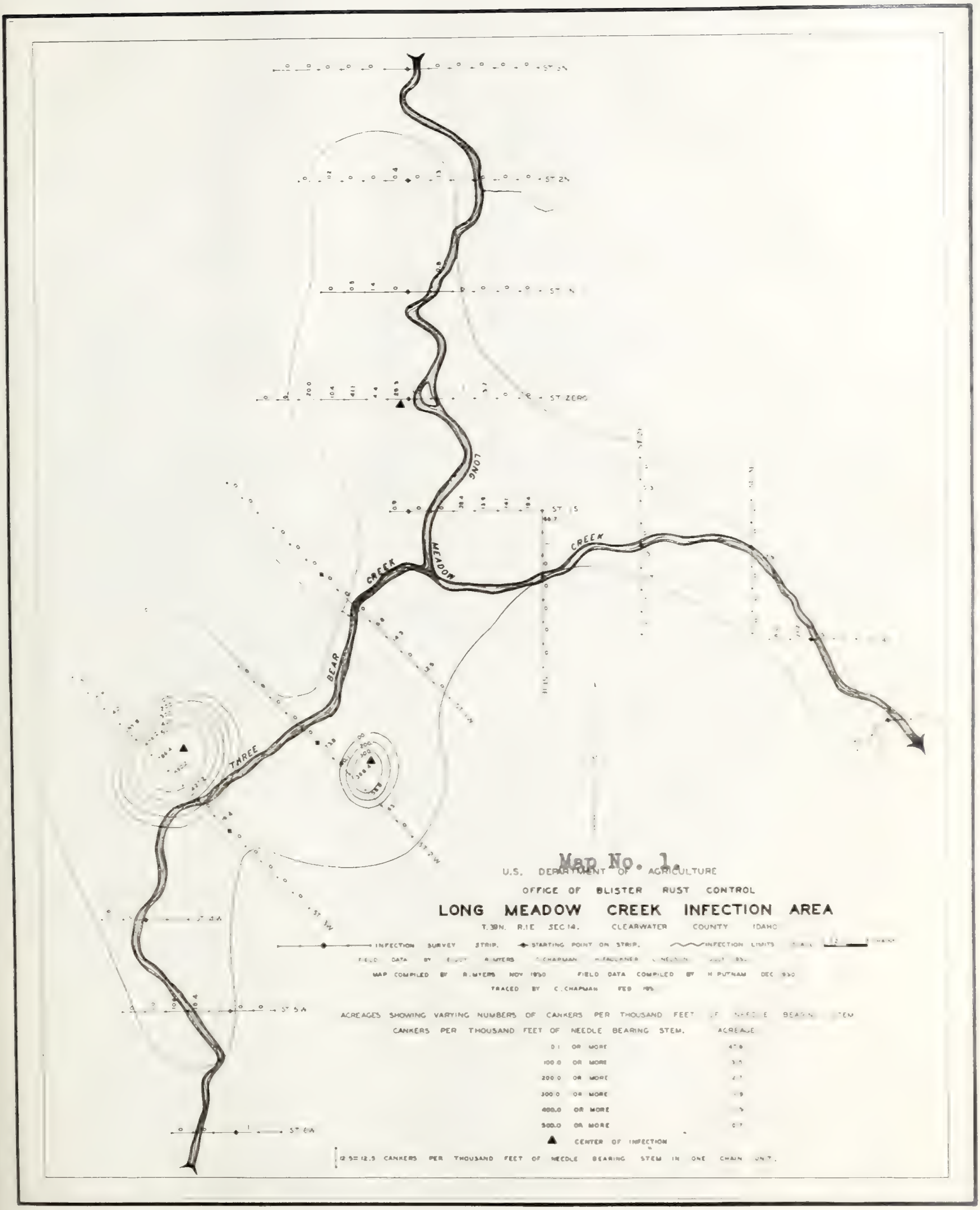
As may be seen in Table No. 3 the relative humidity at each of the four infection centers was decidedly above the corresponding reading at Bovill. There is a fairly uniform difference in the four comparisons. If the intensification of rust on pines is considered to be chargeable to good moisture conditions, as at Long Meadow for example, it must also be admitted that moisture conditions were equally as favorable to rust development at the other three points.

To sum up briefly the important points brought out in Tables No. 2 and 3 it may be stated that moisture conditions were apparently equally favorable to rust development at each of the four infection points; that the species of Ribes and their amounts per acre showed no appreciable effect in causing rust intensification; that the degree of rust severity was directly proportional to the number of pines per acre. The larger the number of pines per acre, the more closely is the association between the Ribes and pines, and the greater the opportunity for pines to become infected from the closely associated Ribes bushes.

The factor of association of Ribes and pines is of very great importance, particularly so in causing many cankers per tree. This fact is further brought out in map No. 1, on which is shown the Long Meadow infection data expressed as infection intensity zones based on the number of cankers per thousand feet of needle stem. It may be observed that at the centers of infection there were large numbers of cankers per unit of pine foliage, and that at increasing distances from the centers the number of cankers per thousand feet of needle stem decreased very rapidly.

CONCLUSION

An analysis of the results of the four disease surveys made in 1930 brings out the fact that when blister rust becomes established under favorable moisture conditions in a young stand supporting the R. lacustre and R. viscosissimum at the rate of 1,000 feet of live stem per acre, serious damage to pines will result. It is also indicated that the degree of association of Ribes and pines may become at least as important a factor in the development of rust as either the abundance or species of Ribes.



Map No. 1.

Annual Report 1930
H. N. Putnam

SUMMARY OF EFFECTIVENESS OF CONTROL STUDIES, 1930

By
H. N. Putnam
Associate Paghologist

The summary of results obtained from studies of the effectiveness of control is shown below:

1. The quantity of Ribes left after eradication is not a fixed amount but one which increases rapidly from year to year by the addition of new growth on old bushes and the formation of new bushes from seeds and sprouts.

2. In stream type, particularly where R. petiolare was abundant before eradication, seedlings of R. petiolare are often present in large numbers one and two years after the eradication work was done.

3. Studies made at Cheekye, B.C., show definitely that under conditions existing at Cheekye 1,250 feet does not constitute a safe width for a protection zone. Indications at Cheekye are that the pines may have become infected from sporidial sources a mile away.

4. Based upon a determination of the number of cankers per thousand feet of needle stem, studies now indicate that in the West P. monticola may be nearly 8 times as susceptible to blister rust as P. strobus.

5. Analysis of data gathered by infection surveys apparently indicates that the degree of association of pines and Ribes is a highly important factor in intensifying the rust on pines. This factor was much more important than either the relative susceptibility of the Ribes, or their amounts per acre. For example, at Long Meadow there were cankers at the rate of 28.8 per thousand feet of needle stem. These were chargeable to 1,081 feet of live stem of R. lacustre and R. viscosissimum per acre growing in very close association with the pines. By way of contrast, on the St. Maries River infection area there were only 1.8 cankers per thousand feet of needle stem chargeable to 85,285 feet of live stem per acre, chiefly R. petiolare. Thus on the St. Maries River area there were found 85 times as many Ribes per acre and only 1/15 as many cankers per unit of foliage as were found at Long Meadow. However, the Ribes on the St. Maries River area were in stream type and not so closely associated with pines as at Long Meadow.

6. A high relative humidity during the period of rust activity is very favorable to intensification of the disease.

SUMMARY OF EFFECTIVENESS OF CONTROL STUDIES, 1930

By
H. N. Putnam
Associate Pathologist

The summary of results obtained from studies of the effective-
ness of control is shown below:

1. The quantity of Ribes left after eradication is not a fixed amount but one which increases rapidly from year to year by the additio[n] of new growth on old bushes and the formation of new bushes from seeds and sprouts.

2. In stream type, particularly where R. petiolare was abundant before eradication, seedlings of R. petiolare are often present in larg[e] numbers one and two years after the eradication work was done.

3. Studies made at Cheakye, B.C., show definitely that under conditions existing at Cheakye 1,250 feet does not constitute a safe width for a protection zone. Indications at Cheakye are that the pines may have become infected from sporidial sources 1 mile away.

4. Based upon a determination of the number of cankers per thousan[d] feet of needle stem, studies now indicate that in the West P. monticola may be nearly 3 times as susceptible to blister rust as P. strobus.

5. Analysis of data gathered by infection surveys apparently indicates that the degree of association of pines and Ribes is a highly important factor in intensifying the rust on pines. This factor was much more important than either the relative susceptibility of the Ribes or their amounts per acre. For example, at Long Meadow there were cankers at the rate of 23.8 per thousand feet of needle stem. These were chargeable to 1,081 feet of live stem of R. lacustre and R. viscosissimum per acre growing in very close association with the pines. By way of contrast, on the St. Maries River infection area there were only 1.3 cankers per thousand feet of needle stem chargeable to 25,235 feet of live stem per acre, chiefly R. petiolare. Thus on the St. Maries River area there were found 25 times as many Ribes per acre and only 1/15 as many cankers per unit of foliage as were found at Long Meadow. However, the Ribes on the St. Maries River area were in stream type and not so closely associated with pines as at Long Meadow.

6. A high relative humidity during the period of rust activity is very favorable to intensification of the disease.

COSTS

The costs of Project 4.2 for the calendar year 1930 are shown below:

TABLE NO. 1

COSTS OF PROJECT 4.2, 1930

Item	Jan. 1 – June 30 1930	July 1 – Dec. 31 1930	Total
Salaries	$3,942.96	$4,070.31	$ 8,013.27
Travel & Subsistence	899.01	2,201.39	3,100.40
Equipment & Miscellaneous	* 663.82	3.01	666.83
Total	$5,505.79	$6,274.71	$11,780.50

*$469.55 of the equipment charge was for a Chevrolet truck.

[illegible] 1930

[illegible]

The survey of results obtained from studies of the effectiveness of control is shown [illegible]:

1. The Ribes population is not a fixed amount but one which increases rapidly from year to year by the addition of new growth on old bushes and the formation of new bushes from seeds and sprouts.

2. [illegible]

3. [illegible] may have become infected [illegible].

4. Analysis of data gathered by infection surveys apparently indicates that the degree of association of pines and Ribes is a highly important factor in intensifying the rust on pines. This factor was much more important than either the relative susceptibility of the Ribes or their numbers per acre. For example, at Long Meadow there were cankers at the rate of 21.4 per thousand feet of needle area. These were chargeable to 1,081 feet of live stem of R. lacustre and R. [illegible] per acre growing in very close association with the pines. By way of contrast, on the St. Maries River infection area there were only 1.3 cankers per thousand feet of needle area chargeable to 43,[illegible] feet of live stem per acre, chiefly R. petiolare. Thus on the St. Maries River area, there were found 40 times as many Ribes per acre and only 1/16 as many cankers per unit of foliage as were found at Long Meadow. However, the Ribes on the St. Maries River area were in stream type and not so closely associated with pines as at Long Meadow.

5. A high relative humidity during the period of rust activity is very favorable to intensification of the disease.

EDUCATIONAL WORK, 1930
By
Kermit Miller
Agent

INTRODUCTION

During 1930 the educational program of the Western Office of Blister Rust Control was carried on in Washington, Oregon, California, Idaho and Montana. Work in other states consisted of supplying information when definite requests were received, with the exception of the material furnished to the National Parks in the West outside of the five states mentioned.

As in the past, the work in Montana, Oregon and California was done by, or under the direction of, the state leaders with the aid of material furnished by the Spokane Office. Treatment of the work in those states may be found in the reports of the state leaders. This report deals only with work done from the Spokane Office.

PURPOSE

Educational work is done largely with five groups: Blister-Rust workers, the Forest Service personnel, timber owners and operators, colleges and the general public. The purpose of the work, therefore, is to give the Blister-Rust workers the progress and results of the work and the relation of the various projects to the general plan of work; to instill a realization of the menace blister rust holds over white pine into the minds of timber owners, both public and private; to establish the necessity of preserving actual and potential timber assets in the minds of the Forest Service officials, timber owners and the general public; to supply forestry schools with information and material so that students may have a working knowledge of blister rust and its control, and to make contact with and give some knowledge of blister rust and its control to a portion of those not in direct contact with blister-rust-control work in order that general interest in and support for the control program may be secured.

SUMMARY

Prior to 1928 educational work in the Spokane Office was relegated to a secondary place due to the fact that the project leader had several other projects which required a majority of his time. In 1928 a full time project leader was put in charge of the work, and a permanent assistant was appointed in October of the same year.

In 1930 a further expansion was deemed advisable, not in personnel, but in methods of work. This expansion took the form of a larger amount of photographic work. In light of this development a

fully equipped photographic dark room was installed in the Spokane Office. H. A. Cowling, a photographer, was appointed July 1 as general assistant to the educational project leader.

The work accomplished during 1930 now properly falls under three general headings: (a) preparation of material; (b) distribution of material and information; (c) photographic work.

A. Preparation of Material

1. Specimens. The best method so far used for disseminating blister-rust information is by the use of actual specimens of the disease in all its stages. A working knowledge of blister-rust control cannot be developed without a thorough knowledge of the disease itself, which is best secured through the use of illustrative specimens.

Diseased Ribes leaves, showing both the telial and uredinial stages of the rust, are mounted on cards 4"x 6", covered with celluloid and bound with tape. Approximately 2,000 leaves of each stage were collected and pressed to be used in the mounts. In addition, 24 quarts of each stage were collected and pickled to be used in laboratory work.

A total of 268 uredinial and 260 telial mounts were made up during the year. Of that number 195 each of uredinia and telia were sent to the three state leaders, the remainder being supplied to educational institutions and individuals from the Spokane Office.

The pickled leaves were preserved in test tubes to be used for microscopic examination of spores in the class rooms of educational institutions of the West. Thirty-two tubes of each stage were supplied to the state leaders. For use from the Spokane Office they are put into test tubes as needed.

Cankers showing the five stages of development on pine, from early development to aecial production, were preserved in test tubes. 600 of them were used in demonstration boxes, 130 were sent to state leaders, and 133 are on hand for future use. In addition to the individual specimens nine quart jars filled with slightly larger aecial specimens were sent to state leaders, and a number were used in local demonstrations from the Spokane Office.

A number of trunk cankers from 18 to 24 inches in length, in large glass jars, were used in demonstration work, three of them being sent to state leaders.

All specimens sent out, whether for display purposes or classroom use, were so treated as to preclude the possibility of viable spores or mycelium remaining in the material. At the time of collection all

[illegible] equipped photographic dark room was installed in the Spokane Office. R. L. Cowling, a photographer, was appointed July 1 as general assistant to the educational project leader.

The work accomplished during [illegible] may properly falls under three general headings: (a) preparation of material; (b) distribution of material and information; (c) photographic work.

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A total of [illegible] uredial and [illegible] telial mounts were made up during the year. Of that number [illegible] sets of uredial and telial were sent to the three state leaders, the remainder being supplied to educational institutions and individuals from the Spokane Office.

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Cankers showing the five stages of development on pine, from early development to aecial production, were preserved in test tubes. [illegible] of them were used in demonstration work, [illegible] were sent to state leaders, and [illegible] are on hand for future use. In addition to the individual specimens nine quart jars filled with slightly larger aecial specimens were sent to state leaders, and a number were used in local demonstrations from the Spokane Office.

A number of [illegible] cankers from [illegible] to [illegible] inches in length, in large glass jars, were used in demonstration work, three of them being sent to state leaders.

All specimens sent out, whether for display purposes or class-room use, were so treated as to preclude the possibility of viable spores or mycelium remaining in the material. At the time of collection all

specimens are treated with a killing solution. For pine specimens the formula is formaldehyde 2 per cent, glycerin 10 per cent, and water 88 per cent; for Ribes leaves, formaldehyde 5 per cent, glacial acetic acid 5 per cent and a 50 per cent solution of alcohol 90 per cent. The pine specimens and the Ribes specimens to be later preserved in test tubes remain in their respective solutions until sent out; the leaves to be used in dry mounts are immediately placed in plant presses.

Prior to 1930 all pine specimens were preserved in the killing solution, the tubes tightly corked and sealed with wax. Early in 1930 a gelatin formula was developed and is now exclusively used. The formula is 3 ounces granulated Bacto-gelatin, 30 ounces distilled water and one ounce formaldehyde. The hot solution is poured over the specimens and forms a clear, solid medium when it cools, being much more satisfactory than the liquid formerly used.

2. Demonstration boxes. For the past three years two types of demonstration boxes have been in use: a 7-stage box showing all stages of the rust on Ribes and pine, so arranged as to indicate the life cycle, with a one-page legend mounted under celluloid; and a 3-stage box showing the uredinial, telial and aecial stages with a brief legend. 96 of the 7-stage boxes were made up during 1930 of which 58 were sent to state leaders; and 120 of the 3-stage boxes were used during the year, 75 of them being made up in 1929. This type of box will not be used after the present supply is exhausted.

3. Blister rust albums. In the spring of 1929 an album was developed showing the important phases of blister rust work with an explanatory legend for each picture. Eight of these were made up to be used in blister rust camps. In 1930 one more album was made up and the nine were used in the Idaho camps. It is planned to develop more of these before the 1931 field season. They will include the latest information.

4. University sets. Under this heading a comprehensive set of photographs and bulletins was compiled showing the life cycle, spread of the rust, ultimate damage to pine and method of control. Legends were prepared giving more detailed information than is contained in the bulletins. New mimeographed publications are being prepared to replace out-of-date bulletins. 71 of these sets were sent out in 1930, 70 of them going to state leaders.

5. Bulletins. The bulletins used in educational material during 1930 were:

Miscellaneous publication No. 23 - general bulletin dealing with blister rust.

Reprint from "The Timberman" - "White Pine Blister Rust - Its Cause and Control in the West".

Miscellaneous publication No. 27 - "Black Currant Spreads White Pine Blister Rust".

Technical bulletin No. 87 - "White Pine Blister Rust: A Comparison of European with North American Conditions".

Farmers' bulletin No. 1398 - "Currants and Gooseberries - Their Culture and Relation to White Pine Blister Rust".

"Questions and answers - dealing with blister rust and its control.

6. Five-winged panels. These panels were revised in 1929 and were used in 1930 to replace the old ones in the hands of state leaders and collaborators. Two are used in the Spokane Office for use in public demonstrations, fairs, etc.

B. Distribution of Material and Information

1. Blister-Rust personnel. The first duty of the educational project is to keep the Blister-Rust personnel informed on all phases of the control work. The medium employed for this service is the Western Blister-Rust News Letter which was continued in 1930 along the same general lines as in 1929.

Articles printed in the News Letter are written on blister rust and allied forestry subjects by the permanent personnel of the Western Office with a few articles coming from outside sources. During the year all projects are reviewed and latest information supplied. The News Letter also serves as a forum for the discussion of new or untried methods of work. The News Letter was issued each month, averaged nine pages, and was sent to a mailing list of 80, most of whom are directly connected with blister-rust work. During the field season the mailing list was expanded to include all the temporary employees and the contents of the letter were of a less technical nature. Two of these summer News Letters were issued averaging 17 pages in length.

Each of the eradication camps was given a supply of educational material to give the temporary men some knowledge of the blister-rust problem and the control work being done. One 7-stage demonstration box, one album, a complete set of bulletins and a question and answer list were included in the camp sets.

2. U. S. Forest Service. No organized educational program was undertaken with Forest Service workers in 1930. A talk was given by the project leader before a meeting of the Rangers of the St. Joe National Forest in

April. All supervisors and rangers were supplied with demonstration boxes in 1929.

Due to the fact that the new assistant was inexperienced in blister-rust control work, it was necessary for him to accompany the project leader on his field trips in order that he might become familiar with the work in all localities. Consequently the only educational work done with the Forest Service personnel was extemporaneous at chance meetings.

3. General Publicity. Articles dealing with blister rust in all its branches appeared in newspapers in Wallace, Moscow and Lewiston, Idaho; Seattle and Spokane, Washington.

Thirteen lectures were given before the botany and zoology classes of Lewis and Clark High School.

A blister-rust demonstration, contained in three large cases with demountable legs, was developed for the Sportmen's and Tourists' Fair at Spokane, Washington, in May and was also used at the Clearwater County Fair at Orofino, Idaho, and the Bonner County Fair at Sandpoint, Idaho, in September. This demonstration is self-contained and is easily set up by one man in a short time. It is supplemented with an automatic slide projector giving the complete story of blister rust and control methods in pictures and legends. The continuous slide program was valuable in attracting people to the demonstration, the majority of them giving some time to examination of the specimens and other material after they had seen all of the slides. Other material consisted of trunk cankers and smaller cankers in all stages of development, diseased Ribes leaves, colored pictures of the disease and pictures of control work. Bulletins were given to those desiring them.

C. Photographic Work

On July 1 work was started on the installation of the dark room. Enough work was done so that the dark room was available for use when the first field pictures were taken. Since July new equipment has been added and any photographic work can now be handled.

Each year pictures are taken to give a complete picture record of each project. In 1930, however, there was not enough time available to give close coverage to each line of work, but a representative list of pictures was secured and 115 new ones added to the files in the Spokane Office.

During the winter season photographic work consists of the copying of maps, charts, and tables for the annual report, making and coloring lantern slides and enlargements, and the photographing and

April. All supervisors and regions were supplied with demonstration boxes in 1929.

Due to the fact that the new assistant was inexperienced in blister rust control work, it was necessary for him to accompany the project leader on his field trips in order that he might become familiar with the work in all localities. Consequently the only educational work done with the forest service personnel was extemporaneous at ranger meetings.

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Thirteen lectures were given before the botany and zoology classes of Lewis and Clark High School.

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printing of special work for the various projects. In January, 50 copies were made and 18 composite pages laid out for the 1929 annual report.

A total of 3,783 prints was used during the year, exclusive of those printed for the annual report. This number includes all pictures ranging in size from 9x12 centimeters to 8x10 inches. In addition, approximately 50 enlargements were used, mostly as a means of securing 5x7 negatives from smaller negatives.

A large number of pictures were taken as an experiment in color correction photography, also a considerable number were taken to test the feasibility of photographing various kinds of field equipment in the preparation of an eradication field manual.

RECOMMENDATIONS

In order that every project may be given ample time in which to secure all necessary photographs, the purchase of another 5x7 field camera is recommended. Plans for 1931 call for dividing our territory into two parts, H. M. Cowling to do educational and photographic work in one part and the project leader to take care of the other. That plan is not possible without another camera. Our work is scattered over too large a territory for one man to cover it properly.

EXPENDITURES
By
WESTERN OFFICE OF BLISTER-RUST CONTROL
Calendar Year 1930

Federal Expenditures

The following tabulations of Federal expenditures for the periods January - June, 1930, and July - December, 1930 summarize, by projects, the expenditures of the Western Office of Blister-Rust Control.

Expenditures have been classified under the several heads shown in the tabulations for the purpose of better analyzing items of expense charged to each project in preparing project cost statements. To further this objective office records show the classification of all expenditures by object.

TABLE NO. 1

FEDERAL EXPENDITURES, WESTERN OFFICE OF BLISTER RUST CONTROL
January 1, 1930 - June 30, 1930

	Project	Salaries	Expenses	Total	RECAPITULATION OF EXPENSES: Subsistence Expenses	Railroad Fares, Pullman, Stage, Etc.	Operation Personally Owned Autos	Cost of Transportation in Government Trucks	Other Transportation Expenses	Express, Freight, Trucking, and Packing	Supplies and Equipment	Other Miscellaneous Expenses
1.1	Cultivated black currant location and eradication in cooperation with states											
	1.15 - California	$ 945.82	$ 322.05	$ 1,267.87	$ 109.33	$ 84.41	$ 119.14	-	$ 2.27	$ .30	$ 5.50	$ 1.10
2.2	Developing methods of Ribes eradication											
	2.22-1 - Method studies of Ribes eradication, Idaho	6,098.[illegible]	4,948.50	11,047.38	2,029.21	2.42	52.30	$ 38.72	-	483.56	2,016.93	322.36
	2.22-2 - Experimental re-eradication vicinity Bovill, Idaho	130.00		130.00	-	-		-	-	-	-	-
	2.22-3 - Experimental re-eradication Coeur d'Alene National Forest, Idaho	265.00	-	265.00	-	-		-	-	-	-	-
	2.25 - Experimental re-eradication California	2,176.07	1,169.64	3,345.71	643.26	[illegible]	127.14	71.67	3.09	73.97	134.23	87.37
2.3	Developing and testing of Ribicides											
	2.3-1 Laboratory investigations	[illegible].02	4,649.54	9,915.56	541.81	41.[illegible]	122.66	21.50	53.04	155.78	* 2,888.53	124.92
	2.3-2 Field tests	1,1[illegible].68	1,2[illegible].48	2,424.16	213.70	-	-	2.48	-	127.70	** 882.45	9.15
2.4	Studies in Ribes ecology											
	2.42 - Idaho	2,714.43	1,468.65	4,183.08	459.9[illegible]	164.[illegible]	[illegible]	16.89	7.91	14.16	523.19	205.95
	2.44 - Oregon	[illegible]	[illegible]	221.[illegible]	[illegible]		[illegible]	-	-	-	1.60	-
	2.45 - California	[illegible].05	684.10	1,246.15	160.3[illegible]	[illegible]		15.39	2.05	29.36	** 551.25	31.75
3.1	Control reconnaissance on Federal lands											
	3.15 - California	917.21	450.46	1,[illegible].67	[illegible]	24.[illegible]	[illegible]	[illegible]	2.57	37.17	50.15	46.10
3.2	Ribes eradication on Federal lands											
	3.21 - Savenac Nursery, Montana	[illegible]	[illegible]	[illegible]	[illegible]	34.[illegible]	[illegible].63	-	1.10	3.29	126.92	37.42
	3.23 - Wind River Nursery, Washington	234.80	158.32	[illegible]	125.[illegible]	-	-	-	.25	5.47	18.00	6.60
	3.24 - Mt. Hood National Forest, Oregon	[illegible]	1,414.[illegible]	[illegible]	424.11	42.[illegible]	[illegible]	17.08	4.70	73.41	196.82	58.60
	3.25 - Plumas National Forest, California	316.66	11.17	[illegible]	1.25		7.84	-	-	-	2.08	-
3.3	Ribes eradication in National Parks											
	3.33 - Mt. Rainier National Park, Washington	[illegible]	156.84	[illegible]	[illegible]	47.[illegible]	31.78	-	2.80	6.19	21.31	-
3.4	Cooperative Ribes eradication											
	3.41 - State Forestry Department, Montana	[illegible].70	67.19	[illegible]	62.69	-	-	-	-	4.45	14.05	-
	3.42-1 - Clearwater Timber Protective Association, Idaho	[illegible]	5,443.68	11,744.67	3,315.66	-	31.15	71.65	-	780.86	1,137.56	116.80
	3.42-2 - Potlatch Timber Protective Association, Idaho	6,837.44	6,146.40	12,98[illegible].84	3,379.51	8.00	29.82	68.42	.24	708.92	** 1,823.05	130.44
4.1	Field studies, spread of the rust											
	4.12 - Idaho	300.99	290.38	# 591.37	124.87	129.88	18.27	.90	16.46	-	-	-
	4.13 - Washington	[illegible]	165.52	# 432.18	104.65	24.55	-	1.78	33.59	-	.70	.25
	4.14 - Oregon	135.00	607.28	742.28	85.26	4.46	-	31.87	.80	.83	** 476.61	5.45
4.2	Damage to pine studies	3,942.96	1,565.07	# 5,508.03	408.65	301.57	113.89	35.25	40.39	3.97	** 649.55	11.80
6.	Educational work, Spokane office and field	1,523.28	862.43	2,385.71	75.35	-	206.99	-	.52	37.33	400.49	141.75
9.	Maintenance of field office and miscellaneous expenses											
	9.1 - Supervision	[illegible]	886.30	3,186.28	[illegible]	626.67	-	-	22.69	-	-	.15
	9.2 - Office maintenance	7,208.80	1,884.02	9,092.82	54.34	99.55	-	3.27	4.27	-	-	1,722.59
	9.3 - Miscellaneous supplies and services paid on L/A	-	1,162.39	1,162.39	-	-	-	49.67	-	31.20	** 699.49	382.03
	9.4 - Miscellaneous supplies and services paid in Washington		1,684.29	1,684.29	-		-	-		162.19	## 1,52[illegible].10	
Total	January 1 to June 30, 1930	$[illegible].06	$38,836.58	$[illegible]	$13,5[illegible]1.78	$2,451.33	$1,795.37	$[illegible]02.21	$198.74	$2,740.11	$14,134.46	$3,44[illegible]

*Includes purchase of new truck and of laboratory supplies and equipment.
**Includes purchase of new truck for each project so designated.
#Includes salary and expenses of H. N. Putnam February to June while in East.
##Includes item of $256.50 for purchase of mimeograph and $650 for purchase of calculating machine.

Annual [illegible]
W. L. McWold

TABLE NO. 2

FEDERAL EXPENDITURES, WESTERN OFFICE OF BLISTER RUST CONTROL
July 1, 1930 - December 31, 1930

	Project	Salaries	Expenses	Total	RECAPITULATION OF EXPENSES: Subsistence Expenses	Railroad Fares, Pullman Stage, Etc.	Operation Personally Owned Autos	Cost of Transportation in Government Trucks	Other Transportation Expenses	Express, Freight, Trucking, and Packing	Supplies and Equipment	Other Miscellaneous Expenses
2.2	Developing methods of Ribes eradication											
	2.22 - Method studies of Ribes eradication, Idaho	$6,945.81	$1,313.81	$8,259.62	$ 101.50	$ 12.70	$ 114.94	$ 16.84	$ 17.25	$ 307.44	$ 362.38	$ 380.76
	2.25 - Experimental Ribes eradication, California	5,354.44	1,612.22	6,966.66	1,062.26	108.64	193.97	18.32	13.30	77.59	94.13	44.01
2.3	Developing and testing Ribicides and Barberricides											
	2.3-1 - Laboratory investigations, Ribicides	8,136.67	3,481.34	11,618.01	687.28	229.06	350.35	64.28	8.51	70.90	* 1,832.04	188.92
	2.3-1 - Laboratory investigations, Barberricides**	1,912.70	982.15	2,894.85	280.03	52.60		-	# 194.04	30.15	351.54	78.79
	2.3-2 - Field tests of Ribicides	2,994.88	1,006.23	4,001.11	472.50	6.71	5.81	7.31	-	138.95	344.75	30.20
2.4	Studies in Ribes ecology											
	2.42 - Idaho	2,180.97	1,378.24	3,559.21	475.70	162.99	312.13	36.63	21.80	16.24	34.28	318.47
	2.44 - Oregon	525.00	480.59	1,005.59	203.75	-	267.68	-	-	-	7.20	1.96
	2.45 - California	1,962.95	678.60	2,641.55	480.99	15.73	-	65.70	1.25	24.61	85.47	4.85
3.1	Control reconnaissance on Federal lands											
	3.15 - California	2,176.66	695.25	2,871.91	426.61	48.99	-	.25	8.25	184.52	13.85	12.78
3.2	Ribes eradication on Federal lands											
	3.21 - Savenac Nursery, Montana	3,653.97	1,289.90	4,943.87	1,073.35	-	214.55	-	-	-	2.00	-
	3.22 - Clearwater National Forest, Idaho	1,800.96	111.35	1,912.31	48.08	5.30	-	-	1.67	-	39.40	16.90
	3.23 - Wind River Nursery, Washington	705.80	411.82	1,117.62	410.56	-	-	-	.10	-	1.16	-
	3.24 - Mt. Hood National Forest, Oregon	2,882.57	1,231.04	4,113.61	742.82	-	306.25	-	4.60	49.40	106.81	21.16
3.3	Ribes eradication in National Parks											
	3.33 - Mt. Rainier National Park, Washington	624.99	202.35	827.34	151.32	36.28	-	-	.90	6.36	3.82	3.67
	3.34 - Crater Lake National Park, Oregon	516.66	223.46	740.12	48.31	50.49	120.54	-	4.13	-	-	-
3.4	Cooperative Ribes eradication											
	3.41 - State Forestry Department, Montana	767.25	273.60	1,040.85	273.60	-	-	-	-	-	-	-
	3.42-1 - Clearwater Timber Protective Association, Idaho ##	6,538.49	2,400.34	8,938.83	1,465.73	76.64	31.78	97.60	5.40	317.13	307.34	98.72
	3.42-2 - Potlatch Timber Protective Association, Idaho ##	7,618.48	1,793.53	9,412.01	820.26	5.30	68.53	33.88	18.05	528.12	239.66	79.71
4.1	Field studies, spread of the rust											
	4.11 - Montana	1,623.33	218.30	1,841.63	67.91	-	140.00	7.39	-	-	-	3.00
	4.12 - Idaho	785.33	312.68	1,098.01	184.17	3.65	113.47	3.49	7.70	-	-	.20
	4.13 - Washington	-	53.70	53.70	18.50	.67	33.38	-	-		1.15	-
	4.14 - Oregon	1,691.99	1,137.23	2,829.22	379.60	17.35	177.80	268.94	60.50	.94	18.45	13.65
	4.15 - California	1,949.45	772.54	2,721.99	376.43	67.09	297.22	23.45	38.52	.86	.83	8.14
4.2	Damage to pine studies	4,070.31	2,217.63	6,287.94	1,450.26	124.90	508.94	67.06	41.92	19.18	3.81	1.56
8.	Educational work, Spokane office and field	1,699.98	1,243.41	2,943.39	237.56	176.56	151.20	19.79	19.80	10.69	606.32	21.49
9.	Maintenance of field office and miscellaneous expenses											
	9.1 - Supervision	2,299.98	365.25	2,665.23	116.33	199.93	-	-	47.14	-	1.75	.10
	9.2 - Office maintenance	7,168.71	1,844.20	9,012.91	37.80	-	-	8.92	.20	-	-	1,747.28
	9.3 - Miscellaneous supplies and services paid on L/A	-	516.79	516.79	-	-	-	172.85	41.60	6.14	251.87	4[illegible].33
	9.4 - Miscellaneous supplies and services paid in Washington	-	240.54	240.54	-	-	-	-	-	48.46	192.08	-
Total, July 1 to December 31, 1930		$78,590.53	$28,488.09	$107,078.62	$12,253.21	$1,456.58	$3,408.54	$912.70	$556.62	$1,827.68	$4,902.11	$3,170.65

*Includes supplies and equipment for field and laboratory use.
**Expenditures made from the $6,500 allotted to this office by the Office of Barberry Eradication.
#Includes rental and operation of truck, Maumee, Ohio, $131.63.
##See also separate summary of expenditures from Association funds for these projects.
Outstanding freight and express items for various projects, estimated at $190, not included in above totals.

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W. L. McWold

Cooperative Expenditures.

The following table summarizes the expenditure of cooperative funds on Ribes eradication by the Clearwater and Potlatch Timber Protective Associations.

The Association funds were deposited as a special account in the U. S. Treasury and disbursed by the Western Office of Blister Rust Control.

TABLE NO. 3

SUMMARY OF BLISTER RUST CONTROL COOPERATIVE RIBES ERADICATION EXPENDITURES
BY THE
CLEARWATER AND POTLATCH TIMBER PROTECTIVE ASSOCIATIONS
July 1, 1930 - September 30, 1930

Cooperating Agency	Wages	Expenses	Total	Subsistence Supplies	Transportation of Equipment and Supplies	Miscellaneous Supplies and Services
Clearwater Timber Protective Association	$ 8,273.02	$1,726.98	$10,000.00	$1,308.01	$399.37	$19.60
Potlatch Timber Protective Association	8,647.49	1,352.51	$10,000.00	895.86	383.23	73.40
Grand Total	$16,920.51	$3,079.49	$20,000.00	$2,203.87	$782.60	$93.00

As shown above the allotments for each association for the field season of 1930 were expended in full during the period July 1, 1930 to September 30, 1930.

For Federal expenditures on these projects see projects 3.42-1 and 3.42-2 on Statements of Western Federal Blister Rust Control Expenditures January 1, 1930 to June 30, 1930 and July 1, 1930 to December 31, 1930.

GENERAL SUMMARY

I. Delaying Spread of the Rust

A. Cultivated Black Currant Eradication.

California - Project completed. One planting of 9 bushes found in Riverside County. Reworking - one planting of six bushes located in San Mateo County, one planting of two bushes in Sacramento County.

II. Development of Local Control Practice

A. Re-eradication.

1. California - 5,825 acres, 87 per cent of the 1926 and 1927 eradication areas on the Stanislaus National Forest, were reworked. 180,909 bushes having 1,004,757 feet of live stem, an average of 31 bushes and 173 feet of live stem per acre, were pulled.

B. Development and Testing of Ribicides.

1. Chemical investigations summary.

a. Results of 1929 experiments. The toxic action of X and Y copper complex sprays were unsatisfactory on Ribes in Idaho, Oregon and California. It is evident that the complex compound is not stable enough under the influence of reactive plant constituents to permit translocation of the chemical into root tissue.

b. Field tests of Ribicides, 1930. Laboratory investigation and greenhouse tests to date suggested: (1) the use of buffered sodium chlorate and Atlacide sprays in place of sprays merely adjusted with dilute acid or alkali; (2) the use of copper complex, cadmium sulphate, cadmium chloride and zinc ammonium chloride as a crown or stem application, (3) pitch oil, Diesel oil and Edleanu extract containing as a solute varying amounts of furfural, pyridene, benzene, toluene and naphthalene.

Many variations of these methods were tested on the several species of Ribes found in Idaho, California, and Oregon. While definite results cannot be determined until the field season of 1931, late season observations in 1930 indicated that copper complex, cadmium sulphate, cadmium chloride and sodium chlorate are excellent killing agents when injected into or applied to incisions on stems or roots. A method of packing copper complex paste into the basal portions of R. inerme showed excellent top kill and merits further investigation. R. roezli injected with copper complex by means of a

GENERAL SUMMARY

I. Reducing Spread of the Rust

A. Cultivated Black Currant Eradication.

California - Project completed. One planting of 9 bushes Cou
in Riverside County, Reverting - and planting of six bushes located i
San Mateo County, one planting of two bushes in Sacramento County.

II. Development of Basal Control Practices

A. Re-eradication.

1. California - 5,523 acres, 97 per cent of the 1920 and 1921
eradication areas on the Stanislaus National Forest, were reworked.
180,909 bushes having 1,001,737 feet of live stem, an average of 31
bushes and 175 feet of live stem per acre, were pulled.

B. Development and Testing of Ribicides.

1. Chemical investigations summary.

a. Results of 1929 experiments. The toxic action of X an
Y copper complex sprays were unsatisfactory on Ribes in Idaho, Oregon
and California. It is evident that the complex compound is not stable
enough under the influence of reactive plant constituents to permit
translocation of the chemical into root tissue.

b. Field tests of Ribicides, 1930. Laboratory investigatio
and greenhouse tests to date suggested: (1) the use of buffered sodium
chlorate and ribicide sprays in place of sprays merely adjusted with
dilute acid or alkali; (2) the use of copper complex, calcium sulphate
sodium chloride and zinc ammonium chloride as a crown or stem
application, (3) pitch oil, diesel oil and Edleanu extract containing
as a solute varying amounts of furfural, pyridene, benzene, toluene an
naphthalene.

Many variations of these methods were tested on the several
species of Ribes found in Idaho, California, and Oregon. While
definite results cannot be determined until the field season of 1931,
late season observations in 1930 indicated that copper complex,
calcium sulphate, sodium chloride and sodium chlorate are excellent
killing agents when injected into or applied to incisions on stems or
roots. A method of packing copper complex paste into the basal
portions of R. lacustre showed excellent top kill and merits further
investigation. R. roezlii injected with copper complex by means of a

Zerk pressure gun showed some resprouts. Pitch oil proved too irritating to the skin to warrant large-scale application. Diesel oil proved quite as effective as pitch oil. No releafing was observed on R. roezli which had been sprayed with Diesel oil. Dilute cadmium sulphate and cadmium chloride sprayed on R. inerme showed complete kill of live stem at the end of growing season. No conclusions could be drawn regarding increased toxicity of buffered sodium chlorate and Atlacide solutions.

c. Barberry investigations. In cooperation with the Office of Barberry Eradication investigations were initiated to develop chemicals toxic to barberry. Tentative results indicate that the barberry lends itself to a flexible program of chemical eradication being rather susceptible to chemicals applied as a spray and as a crown application in both liquid and solid form.

2. Field tests of chemicals - Clarkia, Idaho. Results of spraying in 1929 indicate that the toxicity of sprays increases with the advance of the season, the optimum effectiveness being from about July 25 to August 7 with a general falling off in toxicity after August 15; sodium chlorate sprays are more effective than Atlacide or the sodium chlorate-calcium chloride mixture on all species throughout the season, and show the smallest seasonal variation in toxicity; strongly acid sprays at pH 4.0 were less effective than more nearly neutral sprays at pH of 6.5 and 8.0.

C. Studies in Ribes Ecology.

1. Inland Empire. Data taken in a study of the organic mantle of the forest floor indicate that no important changes take place in the depth of either the duff or humus layers during the development of a timber stand from the pole stage to the mature. Ribes seeds must be located in the first thirty years' accumulation if, as previous data indicate, Ribes are not present in dense stands more than 30 years old. Tentative results of studies to locate Ribes seeds indicate that 60 to 80 per cent of the seeds stored in the organic mantle are in the humus layer awaiting favorable conditions for germination.

These field studies resulted in carefully controlled laboratory investigations of the various factors which control Ribes seed germination. Present results indicate that: (1) alternating temperature combinations are much better for germination than constant, since about 90 per cent of the seeds germinated were in the four alternate temperature combinations; (2) neutral peat is a more favorable germination medium than acid peat, as 93 per cent of the seeds germinated were in the neutral medium.

Bark pressure gun showed some response. Pitch oil proved too irritat[illegible]
to the skin to warrant large-scale application. Diesel oil proved not
as effective as pitch oil. No releafing was observed on *R. [illegible]*
which had been sprayed with Diesel oil. [illegible] calcium sulphate and
sodium chlorate sprayed on *R. [illegible]* showed complete kill of live [illegible]
at the end of growing season. No conclusions could be drawn regarding
increased toxicity of buffered sodium chlorate and Atlacide solutions.

c. Barberry Investigations. In cooperation with the Office [illegible]
Barberry Eradication investigations were initiated to develop chemical[illegible]
basic to barberry. Tentative results indicate that the barberry lends
itself to a flexible program of chemical eradication being rather
susceptible to chemicals applied as a spray and as a crown application
in both liquid and solid form.

2. Field tests of chemicals - [illegible], Idaho. Results of spray[illegible]
in 1923 indicate that the toxicity of sprays increases with the advance
of the season, the optimum effectiveness being from about July 20 to
August 7 with a general falling off in toxicity after August 15; sodium
chlorate sprays are more effective than Atlacide or the sodium chlorate
calcium chloride mixture on all species throughout the season, and show
the smallest seasonal variation in toxicity; strongly acid sprays at pH
2.0 were less effective than acid and nearly neutral sprays at pH of 4.0 and
6.0.

C. Studies in Range Ecology.

1. Animal ecology. Data taken in a study of the organic mantle of
the forest floor indicate that no important changes take place in the
depth of either the leaf or humus layer during the development of a
timber stand from the pole stage to old maturity. Ribes seeds must be
located in the first thirty years' accumulation if, as previous data
indicate, Ribes are not present in dense stands more than 50 years old.
Tentative results of studies to locate Ribes seeds indicate that 80 to
85 per cent of the seeds stored in the organic mantle are in the humus
layer awaiting favorable conditions for germination.

These field studies resulted in carefully controlled laboratory
investigations of the various factors which control Ribes seed germinati[illegible]
Present results indicate that: (1) alternating temperature conditions
are much better for germination than constant, since about 70 per cent [illegible]
the seeds germinated were in the four alternate temperature conditions;
(2) neutral peat is a more favorable germination medium than acid peat,
as 51 per cent of the seeds germinated were in the neutral medium.

2. California. Permanent plots have not been established long enough to give definite information. Temporary plots indicate that: (1) 3-year R. roezli bushes produce few fruits, 4-year bushes bear heavy crops; (2) Ribes establishment begins immediately after logging; Ribes population increases for six years or more, optimum development being in third, fourth, and fifth years; (3) on a heavy burn Ribes establishment proceeds normally for two or three years after which the increase is reduced probably on account of heavy concentration of Ceanothus brush which follows a fire; (4) the average R. roezli bush increases from .1 foot to 33 feet of live stem over a 6-year period.

? 60 in [illegible]

3. Oregon. Ecological studies on the whole have not shown any more than was shown in 1929. Under certain conditions grasses and herbs may play an important role in suppressing Ribes seedlings that come in after eradication.

III. Application of Local Control

A. Control Reconnaissance

1. California - Reconnaissance completed on 122,682 acres on Eldorado National Forest at a cost of $0.0322 per acre.

B. Ribes Eradication on Federal Lands.

1. Clearwater National Forest. Three U. S. Forest Service camps, for which the Office of Blister Rust Control provided the technical supervision, and one methods camp worked 3,266 acres at an average cost of $10.10. 36,745 acres were protected at a cost of $0.898 per acre for the protection afforded by stream type eradication.

A comparison of knapsack and power spraying carried on by the methods camp showed that 109 gallons per acre is the point at which the scope of knapsack spraying ends and that of power begins. As there are few areas on which more than 50 or 60 gallons of spray per acre are required, knapsack spraying methods should be used on all practical operations.

2. Mount Rainier National Park. 316,753 Ribes, 566.2 bushes per acre, were pulled from 559.4 acres at a cost of $11.29 per acre. A pre-eradication survey in this region showed that 16,860 acres need to be worked for the protection of 7,645 acres of white pine type.

C. Ribes Eradication, Savenac Nursery.

Re-eradication work done on 564.2 acres, 200,191 Ribes, 354.8 per acre, were pulled at a cost of $7.57 per acre.

Cutting, piling and burning brush done on 70 acres, the work on 30 acres of which was paid for by the U. S. Forest Service. Promising experiments were carried on with sowing seed for suppression of Ribes through the formation of turf.

D. Ribes Eradication in Oregon.

1. Still Creek - 17,357 Ribes having 360,381 feet of live stem were pulled from 604 acres, 100 acres of which was a recheck of stream type.

2. Wind River Nursery - 6,111 Ribes with 76,010 feet of live stem were eradicated from 413.8 acres including 77.8 acres reworked.

E. Cooperative Ribes Eradication.

1. Idaho.

a. Clearwater Timber Protective Association. 3,055 acres worked at a cost of $7.62 per acre. 61,000 acres were protected at a cost of $0.49 per acre for the high degree of protection afforded by stream type eradication.

b. Potlatch Timber Protective Association. 6,747.4 acres worked at a cost of $4.37 per acre. 165,000 acres were partially protected by stream type eradication at a cost of $0.18 per acre for protection.

2. Montana. In cooperation with the State of Montana 472 acres near Flathead Lake were worked at a cost of $2.33 per acre. 79,371 Ribes, 168.2 per acre, were eradicated by the hand-pulling method.

IV. Field Studies and Collection of Field Data.

A. Spread of the Rust.

1. New pine infections.

a. Idaho - 11 centers of pine infection located; 4 near Headquarters and Pierce, Idaho, 1 on Clearwater National Forest, 4 in the vicinity of Elk River, Idaho, 1 near Clarkia, Idaho and 1 on the St. Joe National Forest.

b. Oregon - 2 infection centers - one on Roaring River in Clackamas County and one on Minto Creek near Independence Ranger Station in Linn County. The latter represents the farthest point south at which pine infection has been located.

Cutting, piling and burning brush done on 70 acres, the work on 30 acres of which was paid for by the U. S. Forest Service. Eradication experiments were carried on with spring seed for suppression of Ribes through the formation of turf.

A. Ribes Eradication in Oregon.

1. Still Creek - 17,357 Ribes bearing 340,341 feet of live stem were pulled from 504 acres, 500 acres of which was a typical stream type.

2. Oak Grove Nursery - 6,111 Ribes with 78,000 feet of live stem were eradicated from 131.5 acres including 77.8 acres reworked.

B. Cooperative Ribes Eradication.

1. In Idaho.

a. Clearwater Timber Protective Association. 4,036 acres were worked at a cost of $1.94 per acre. 62,300 acres were protected at a cost of $0.43 per acre for the high degree of protection afforded by stream type eradication.

b. Potlatch Timber Protective Association. 5,747.4 acres worked at a cost of $4.37 per acre. 155,000 acres were partially protected by stream type eradication at a cost of $0.20 per acre for protection.

2. Montana. In cooperation with the State of Montana 474 acres near Flathead Lake were worked at a cost of $5.53 per acre. 79,371 Ribes, 168.2 per acre, were eradicated by the hand-pulling method.

IV. Field studies and Collection of Field Data.

A. Spread of the Rust.

1. New pine infections.

a. Idaho - 11 centers of pine infection located; 4 near Headquarters and Pierce, Idaho, 1 on Clearwater National Forest, 2 in the vicinity of Elk River, Idaho, 1 near Clarkia, Idaho and 3 on the St. Joe National Forest.

b. Oregon - 2 infection centers - one on Roaring River in Clackamas County and one on Mill Creek near Independence Ranger Station in Linn County. The latter represents the farthest point south at which pine infection has been located.

2. New Ribes infections.

a. Idaho - Ribes infection located at 1 point on the Clearwater National Forest, at 6 points on the Clearwater Timber Protective Association lands and at 2 points in the St. Joe River drainage.

b. Montana - Infection found at 4 points, 1-1/2 to 3 miles from Savenac Nursery.

c. Oregon - Infection located at 2 points in Linn County on Thomas Creek and on Minto Creek and at 1 point in Clackamas County on Roaring River.

B. Effectiveness of Control-Plot Studies

1. Newman Lake, Washington. In 1930 there were nearly twice as many trees infected and three times as many cankers present as in 1929. The increase in the number of Ribes infected in 1930 over 1929 was roughly comparable to the increase in number of fruiting cankers but the increase in infected leaf surface, especially in telia production, was very much greater in 1930 than in 1929. In general higher relative humidity conditions obtained in 1930 than in 1929, possibly accounting in part for the much greater Ribes infection in 1930.

2. Pysht, Washington. The results of the study of the relative susceptibility of Pinus monticola and P. strobus after 5 years subjection to the disease indicate that in the West the P. monticola is 7.8 times as susceptible as P. strobus. In 1928 this rate was determined as 2.9 and in 1929 as 5.7.

3. Cheekye, B.C. In 1930 a survey of the Ribes conditions in the vicinity of the plot revealed the fact that the source of pine-infecting spores was probably three-fourths mile to one mile northwest of the plot. Thus it is probable that at least a 1-mile wide protection zone would be needed at Cheekye and in comparable regions before the pines would be protected.

V. Educational Work

Educational work was carried on with Blister Rust personnel, Forest Service personnel, timber owners and administrators, educational institutions and the general public. Information was disseminated by the use of demonstration material, talks and papers and a monthly news letter.